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NEW TECHNOLOGY JAPAN

INNOVATIVE PRODUCTION NOW

Advanced Safety and Environmental Measures Provided at a LNG Terminal with ISO 14001 – Himeji LNG Terminal of Osaka Gas Co., Ltd. –

Topics

In-situ Observation of Earth's Mantle at 660 km Depth

World's Fastest Speed Recorded by Superconducting Magnetically Levitated Linear Motorcar

NATIONAL R&D PROJECTS

National Research and Development Programs for Medical and Welfare Equipment (2)

GENERIC TECHNOLOGY REVIEW

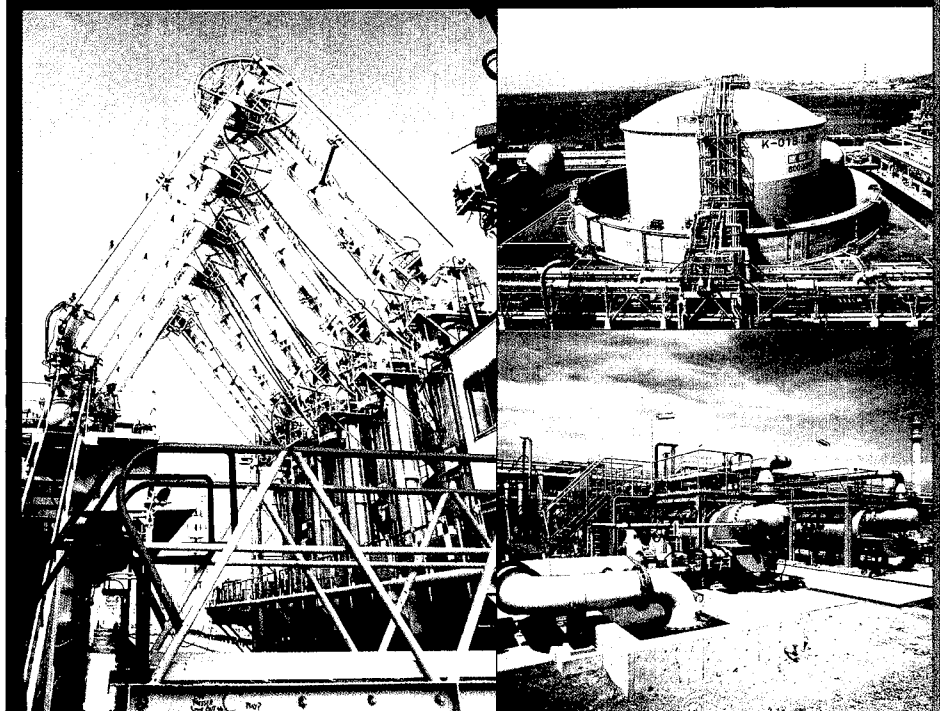
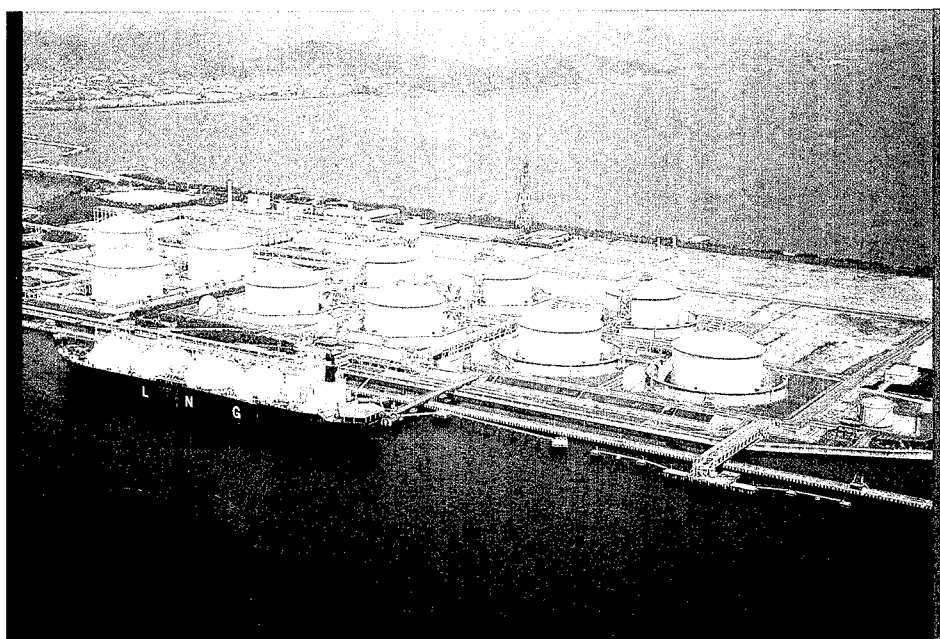
Electronics: Research of Electron-Number Controlling Devices

Electronics: Research of Subpicosecond Devices

HIGH-TECH INFORMATION

Technique for Analysis of Arch Dam Soundness

Industrial Robot for Chamfering Holes on Free Curved Surfaces



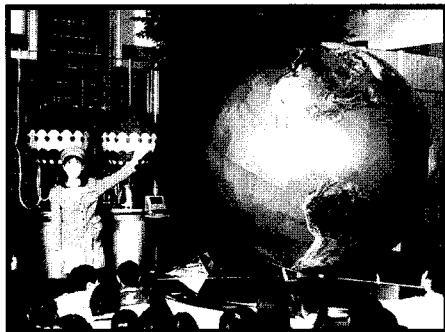
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Cover Photo: Advanced Safety and Environmental Measures

Provided at a LNG Terminal with ISO 14001 – Himeji LNG

Terminal of Osaka Gas Co., Ltd. – (Story on Pages 2-5)

C O N T E N T S

INNOVATIVE PRODUCTS AND SERVICES 2

- **Advanced Safety and Environmental Measures Provided at a LNG Terminal with ISO 14001 – Himeji LNG Terminal of Osaka Gas Co., Ltd. –**

TOPICS 6

- **In-situ Observation of Earth's Mantle at 660 km Depth**
- **World's Fastest Speed Recorded by Superconducting Magnetically Levitated Linear Motorcar**

NATIONAL R&D PROJECTS 8

- **National Research and Development Programs for Medical and Welfare Equipment (2)**

GENERIC TECHNOLOGY PROJECTS 11

- **Electronics: Research of Electron-Number Controlling Devices**
- **Electronics: Research of Subpicosecond Devices**

HIGH-TECH INFORMATIONAL TECHNOLOGY 13

Technique for Analysis of Arch Dam

Soundness 13

Industrial Robot for Chamfering Holes on Free

Curved Surfaces 13

NEW TECHNOLOGY & PRODUCTS 15**Advanced Materials**

- Superconductive Thin Film Material for Electronic Devices Usable at Temperatures of Over 100 K 15
- Superplastic Compressive Deformation Process for Strengthening and Toughening Technology of Silicon Nitride 16

Electronics & Optics

- GHz-Band Electromagnetic Wave Absorber Utilizing Ferrite Magnet 17
- Highly Sensitive and Selective Circular Dichroism (CD) Detector for High-Performance Liquid Chromatography (HPLC) 18
- PIC Mounted PCB for Sequencer 19
- Ultrasonic Wave Automatic Washing Machine 19
- Molecular Beam Epitaxial System with Atomic Layer Monitor 20

Machinery & Mechatronics

- Compact Commercial Rice Polisher 20
- Motor-Driven Strawberry harvesting Work Trolley ... 21
- Wear-Resistant Finishing Abrasive Stick Made of Alumina Fiber 21
- Reliable 7-Axes Hydraulic Press Brake Based on Personal Computer CNC Control 22
- Simplified Takeout System for Vertical Type Forming Machines 22
- Octagon-Type Turntable for Easy Location of Material Center 23
- Angle Machine with Large Machining Capability 23
- Carbide Brazed End Mills with (Al, Ti)N Coating 23
- Metal Die Automatic Slickenside Finishing System .. 23

Information & Communications

- CD-ROM Storing 3-Dimensional Computer Graphic Image Data 24
- Gesture Recognition and Voice Recognition Software Driven Simultaneously with Notebook Personal Computer 25
- Compact, Inexpensive Access Server/Remote Router 26

Process & Production Engineering

- M-Type Driver 27
- Portable Automatic Packing Machine 27
- System for Automatically Heating and Feeding Fluid Materials 28

Machine for Semi-Automatic Fitting of Door

- Handle and Hinge 29
- World's Fastest Palletizing Robot 29
- Micro Parts Feeder 29
- Orthogonal Biaxial Gantry Loader 30

Construction & Transportation

- Tire Regeneration with Coral Grains 31
- Ring Chain Type Rotary Machine for Efficient Steel Skeleton Welding 31
- Voice Recognition Control System for Housing Facilities 32
- High-Performance Engine Control Unit 32
- Car Navigation Software Displaying Direction of Advance with Spotlight 33
- Undercut Anchor System 33
- Fully Hydraulic Low-Noise, High-Speed Excavator with High Performance Power Drill 35
- Passenger Plane Mirror for Visual Surveillance of Passenger Accommodation 35

Energy & Resources

- Technology for Stabilize Methane Gas by Enclosing in Ice 36
- Continuous Manufacture of Germanium in Spherical Form 36

Environment

- Special-Purpose Distillation Combustion Type Incinerator for Medical Treatment Waste 37
- Technique to Recover Phosphoric Acid from Sewage Sludge Incineration Ash 37
- System to Prevent Emission of Dioxin from Incinerator 38

Biotechnology & Medical Science

- pH-Sensitive Contrast Agent for Functional Magnetic Resonance Imaging 39
- Technology to Utilize Flocculent Yeast for Continuous Operation of Bioreactor 40
- Amoxicillin-Resistant Helicobacter Pylori Discovered 40

FLASH**41****Special Stereoscopic Copying System for the Visually Handicapped****Moderately-Priced Version Pen Type Curvimeter**

INNOVATIVE PRODUCTION NOW

This section describes a specialized section or whole process of a representative factory which excels in specific aspects of production.

Advanced Safety and Environmental Measures Provided at a LNG Terminal with ISO14001 Certification

- Himeji LNG Terminal of Osaka Gas Co., Ltd. -

1. Introduction

Natural gas is widely recognized as an ideal energy resource due to no emission of SOx, less emission of NOx and CO₂, and safety compared with other fossil energy resources.

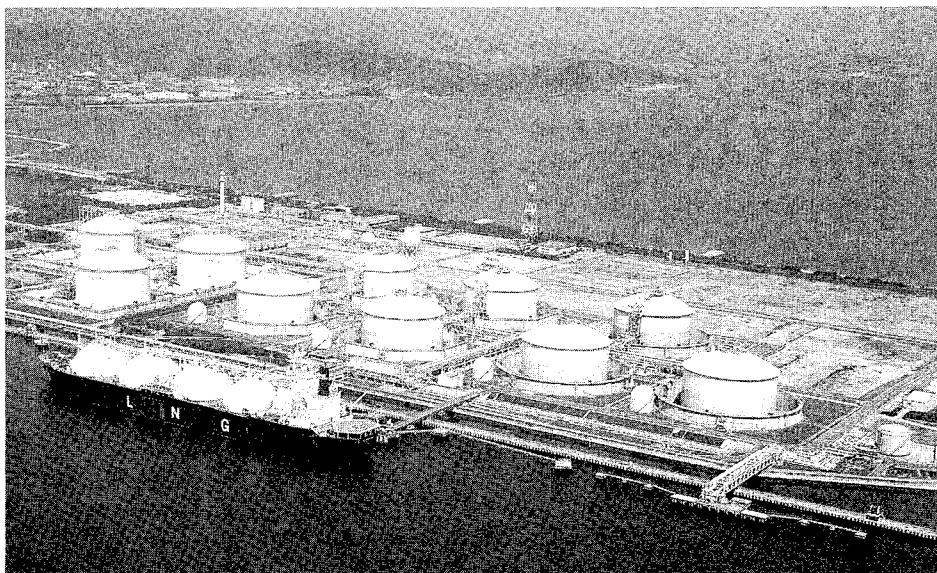
In Japan, a small quantity of natural gas is produced, but at present, a large amount of natural gas for use in electric power generation, city gas and other industrial application is imported as form of liquefied natural gas (LNG). Previously, the gas utilities used coal and oil-based resources as feedstocks.

The first LNG was imported from Alaska on Nov. 1969 by Tokyo Electric Power Co. and Tokyo Gas Co. and Dec. 1972 from Brunei by Tokyo Gas Co., Osaka Gas Co., and Tokyo Electric Power. Since then LNG receiving and vaporization facilities (LNG terminals) were successively constructed, and at present about 20 LNG terminals are operating nationwide, and new one terminal is under planning for construction at Tsuruga by Osaka Gas Co.

Import sources for LNG have also diversified to secure stable supply, and total 7 countries of the U.S.A, Brunei, Abu Dhabi, Indonesia, Malaysia, Australia and Qatar.

LNG imports were 46.5 mil. tons in FY 1996. Use of imported LNG were 13.7 mil. tons by gas utilities and 32.2 mil. tons by electric power utilities in FY1996. LNG consumption of gas utilities is growing.

The increased use of LNG as feedstock has brought various merits in gas production compared with conventional gas pro-



Aerial view of the Himeji LNG Terminal, Osaka Gas Co.

duction such as no generation of environmental hazardous materials, boosting gas production efficiency, etc.

LNG terminals have various features for both supply of clean energy, and non environmental load in production.

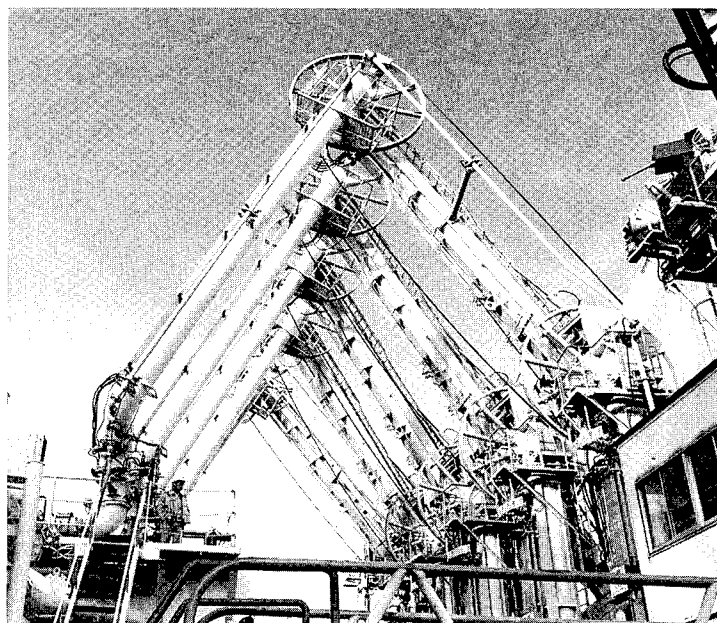
This issue introduces the Himeji LNG Terminal of Osaka Gas Co. as a typical LNG terminal in Japan. The Osaka Gas Co. is ranked No.2 in gas utilities and distributes to more than 6 million users in the Kansai region covering 6 prefectures, and is already operating two LNG terminals, the Senboku LNG Terminal (No.1 & No.2 Terminals) and Himeji LNG Terminal, and at present is planning to construct Tsuruga LNG Terminal which will be completed in 2010.

2. Outline of Himeji LNG Terminal (1) Location & Land Area

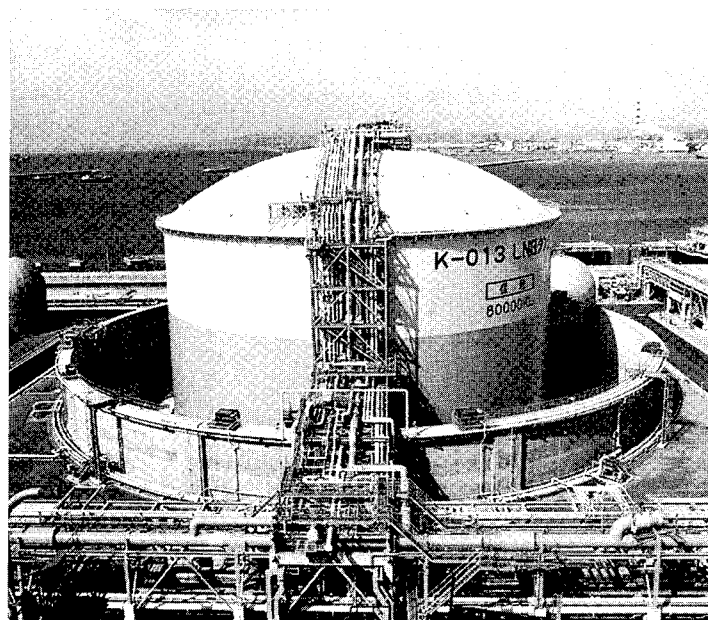
The Himeji LNG Terminal is located in Himeji City, Hyogo Pref., and faces the Seto Inland Sea, and takes about 3 hours and 30 minutes from Tokyo to JR Himeji Station by Shinkansen and 20 minutes from Himeji Station to the site by taxicab.

This LNG terminal was constructed on reclaimed land. The reclamation work started in Nov. 1977, the terminal construction works started in Nov. 1981. The terminal was completed and put into operation in March 1984. The first LNG was received in March 1985 from Indonesia.

At present, the Himeji LNG Terminal is surrounded by various types of planted trees and grass in a natural state.



LNG unloading arms



LNG tank

Table 1. Major facilities and Equipment of Himeji LNG Terminal

The total land area of the terminal is 792,000 m², but is co-shared with the Kansai Electric Power Co. (EPCo.) This is divided into 465,000 m² for Osaka Gas, 132,000 m² for Kansai EPCo., 88,000 m² for co-owned land for new business, and 107,000 m² for a public greenery zone.

(2) Staffs and Operation Setup

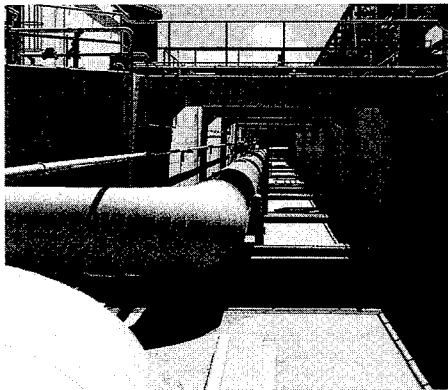
A total 131 staff members are working in this terminal, 7 for general administration, 11 for terminal administration and safety, 39 for engineering and maintenance, 17 for mechanical, 13 for electrical engineering & instrumentation and 8 for system engineering, 51 for production (8 for process engineering and 42 for operation), 11 for a computer system replacement project, and 9 for the Gas Energy Hall.

The terminal is operated under the 24-hour system, and all production processes are controlled by the central control systems equipped with advanced computer control systems with only 6 persons. Now the new and sophisticated computer control system is being installed to replace old systems.

(3) Main Facilities

The Himeji LNG Terminal is divided into the main office buildings, the LNG tank yards with installed 7 units of double-shell type 80,000 m³ capacity LNG tanks, the LNG vaporization yard with 5 trains of Tri-Ex vaporizers (60 t/h x 3, 120 t/h x 1 and 150 t/h x 1), seawater intake facilities yard with 6 pumps (3 7,200 m³/h capacity pumps for LNG vaporizers and 3 3,500 m³/h capacity pumps for fire fighting),

Item	Type & Capacity	No. of Units	Remarks
LNG tank	80,000 m ³	7	Above ground, 9%Ni steel, double-shell type
LNG pump	For plant feed	60 t/h	2/1 LNG tank
	For transfer	300 t/h	2/1 LNG tank
LNG vaporizer	60 t/h	3	Tri-Ex vaporizers
	150 t/h	1	Tri-Ex vaporizers
	120 t/h	1	Tri-Ex vaporizer with 2,800 kW cryogenic power generation plant
Boil-off gas compressor	12 t/h x 9.9 kg/cm ²	4	Reciprocating type
Booster compressor	16 t/h x 45 kg/cm ²	3	Reciprocating type
Return gas blower	27,000 m ³ /h	1	Centrifugal type
LPG tank	For propane	1,500 m ³	Normal temperature, spherical type
	For butane	4,700 m ³	
LPG pump	10 t/h	4	Vertical-shaft, multi-stage type
LPG vaporizer	6 t/h	2	Shell and tube types
	12 t/h	1	
Sea water pump	For vaporizer	7,200 m ³ /h	Mixed-flow type, variable pitch
	For fire-fighting	3,500 m ³ /h	Mixed-flow type, fixed pitch
Boiler	8 t/h	2	Water-tube type
Berth	Main berth	125,000 m ³ (for LNG tankers)	Jointly owned with Kansai EPCo.
	Sub berth	5,000 tons (for tankers)	
Lorry shipment facilities	12.5 t/h	3	
LNG cylinder filling station	5,250 l/d	2	
Back-up power generation facilities	2,800 kW	2	Gas turbine driven type
Operation control system	Minicomputer	7	
	microcomputer	100	
	optical cable	2 loops	
Disaster prevention computer system	Minicomputer	2	
	Optical cable	2 loops	



LNG receiving piping installed in culvert

BOG (boil-off gas) compressor yard with 4 units of compressors, the LNG shipment facility yard, the LPG tank yard with 2 units of 1,500 m³ capacity for propane and 2 units of 4,700 m³ capacity for buthane, the fire-prevention and fire-fighting facilities yard, the maintenance facilities yard, the power substation yard, the calorific adjustment facility yard, the LNG shipment facility yard, the water service facilities yard, the welfare facility yard and the Gas Energy Hall.

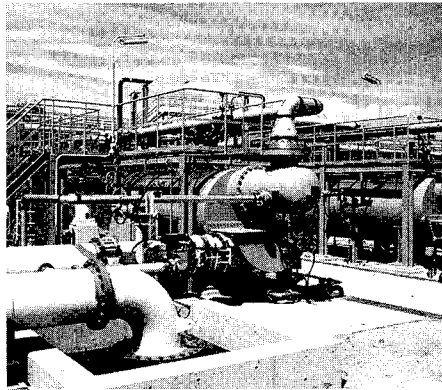
The major facilities and equipment with specifications are shown in Table 1.

(4) Operation

1) Receiving of LNG

Himeji LNG Terminal has imported about 1.4 million tons of LNG per year from Indonesia, Malaysia and Australia, and the near future from Qatar and Oman. The LNG unloading cycle per month is five or six times from 125,000 m³ capacity LNG tankers. The handling capacity of LNG in Himeji LNG Terminal is 2.6 million tons.

Unloaded LNG is stored in 9%Ni steel double shell structured LNG tanks, and fed to the LNG vaporizer to convert natural gas. The basements of the LNG tanks are supported by about 600 steel-tube piles with 700 mm dia. driven on rockbed about 30 meters underground. The structure of the LNG tanks is shown in the figures.



Tri-Ex type vaporizers

2) Vaporization

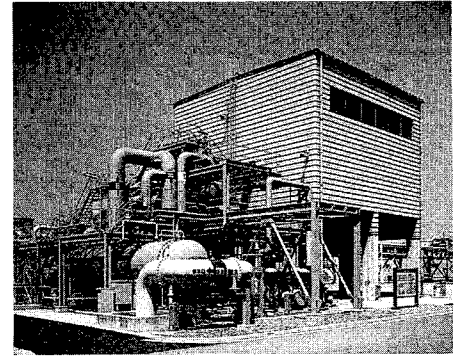
LNG is vaporized by especially developed 5 units of Tri-Ex vaporizers using seawater as heating medium which is hot seawater supplied from the Himeji Thermal Power Plants of Kansai EPCo. where seawater is used as cooling water for the power plant, and stored seawater ponds.

The terminal is planning to install a new type of advanced open-rack vaporizer (ORV) as the No.6 unit.

The terminal has installed the movable-blade type water pumps for seawater intake to feed the vaporizers. This water pump is operated according to the degree of load of vaporizers, so contributes energy saving for pump operation.

3) Shipment and Calorific Value Adjustment

For distribution to general households and industrial users, the calorific value is adjusted from about 10,600 - 10,800 kcal to 11,000 kcal (13A gas: high calorie gas) by adding LPG, and added the odorant to avoid gas leaking accident at the users because LNG has no smell. Generally, the natural gas produced from the LNG is distributed in large gas transmission pipelines, but in some cases by lorry transportation to booster stations with no-connection to trunk gas transmission pipeline networks.



Tri-Ex type vaporizer with 2,800 kW cryogenic power generation plant

4) Operation Control

All of these facilities are controlled by the central operation control room with 2 loop networks and only 6 operators. At present, the computer operation control system is being replaced with advanced systems equipped with voice recognition systems.

(5) Cryogenic Power Generation System

The Himeji LNG Terminal has installed the cryogenic power generation plant with capacity of 2,800 kW at the 120t/h capacity Tri-Ex vaporizer which it also developed. This power plant supplies about half of the electricity consumed in the terminal.

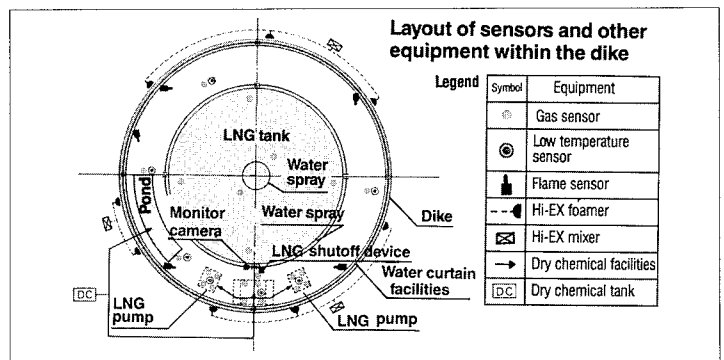
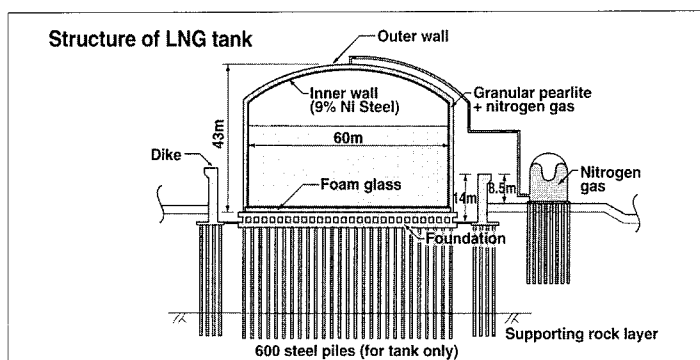
3. Environmental Preservation Measures

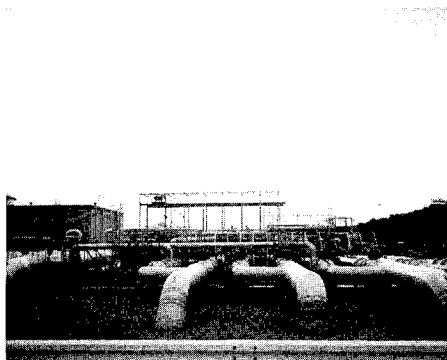
Osaka Gas has already established the basic environmental preservation guideline, and the production divisions have also established environmental preservation guidelines based on the basic guidelines.

These activities are called the Environmental Management System (EMS).

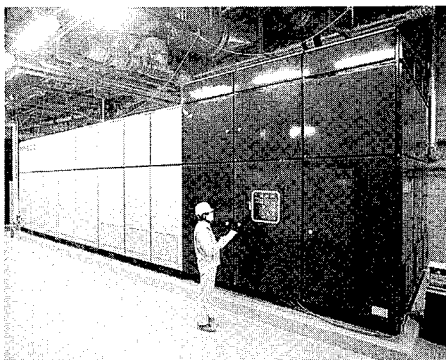
The Himeji LNG Terminal has also promoted various environmental preservation activities as well as energy-saving measures as follows.

1. To reduce the environmental load and prevent contamination by aggressively





Natural gas trunk transmission pipelines



Fuel cell power generation equipment



Natural gas powered vehicle

tackling and promoting environmental activities as follows:

- 1) To maintain the city gas quality and stable supply
- 2) To reduce exhaust gas which affects the local area and global environment
- 3) To create new energy using cryogenic energy, etc. and to achieve the effective utilization of energy
- 4) To promote resource-saving by reducing waste
- 5) To contribute to environmental preservation in local areas and to create comfortable conditions in working areas
2. Obey the environmental laws and ordinances, and others.

As a result of these aggressive activities, the Himeji LNG Terminal acquired the ISO14001 Certification on Oct.13, 1997.

So, the Himeji LNG Terminal is called a clean energy production plant that generates no environmental hazardous materials, and product natural gas also has lower environmental load compared with other energy resources.

As for the other types of environmental preservation, the terminal uses natural gas driven vehicles developed in cooperation with automakers.

Plantation of various species of trees and grass is also promoted, and now these plants are grown as natural state and to

form greenery belts surrounding the terminal.

4. Safety Measures

Various safety measures are provided in the terminal, especially at the LNG tanks and seaberth, and unloading pipeline areas.

Safety measures for LNG tanks are maintained by various types of sensors installed around the tanks including gas detectors, temperature detectors and flame detectors, and various types of fire-fighting systems including hydrants with seawater, formed gas and dry-chemical fire-fighting devices.

At the berth, the emergency release system is installed. These sensors and fire-prevention and fighting equipment are controlled by computer systems. When emergency, various safety facilities and equipment work instantaneously to resolve the emergency.

5. Cost-Effective Terminal Management

As with the environmental preservation activities, the terminal has also promoted cost-effective management activities such as TPM (Total Preventive Maintenance) activities from 1985, and kickoff from 1986, and received the PM Special Prize in Oct., 1992. These activities are also

continuing at present as Phase 4.

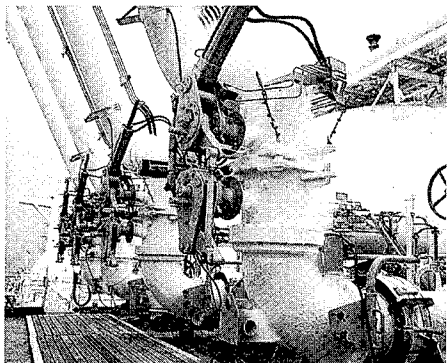
So, various technologies for preventive maintenance were developed such as laser type tide level and wave level measuring instruments for safety of LNG tankers, and fuel cell power generation equipment, and introduced into the terminal.

6. Himeji Gas Energy Hall

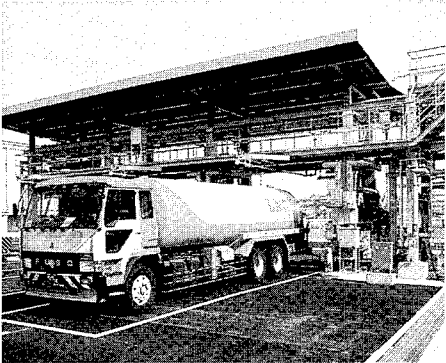
The gas energy hall was constructed in 1985 and opened in Nov. of the same year to provide public-relation services and promote the understanding of LNG gas utilities to people in local areas. It is equipped with various pleasure exhibits related to gas, especially LNG, image theaters, and the experiment facilities for gas. The hall has received an average of about 25,000 visitors every year from kindergartners, primary school children to aged people.



Inside view of Gas Energy Hall



ERS systems



Lorry shipment facilities

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TOPICS

This section describes selected developments of special importance or interest due to the achievement of a breakthrough or innovation in technology.

In-situ Observation of Earth's Mantle at 660 km Depth

Prof. Irifune of the Faculty of Science, Ehime University, and his team have succeeded in in-situ observation of the earth mantle material at a depth of 660 km using the world's largest synchrotron radiation facilities, the Spring-8, and gained fundamental knowledge about current mantle structures.

The SPring Eight Energy-Dispersion Device is operated with a 1500 ton press (SPEED-1500) installed at SPring-8 facilities. This device has a height of about 3 meters and a weight of more than 10 tons, but has a micron level precision stage with a three-dimensional movement capability so that the thin X-ray beam hits the specimen correctly.

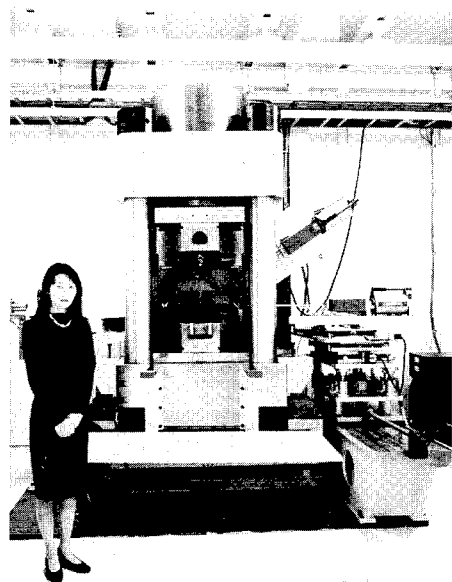
The earth consists of three layers including the thin layer near the surface called the crust, the core in the center,

and the mantle between them. The mantle is the most important region occupying about 80% of the volume of the earth, which is divided into three regions by two surfaces where seismic wave velocities vary discontinuously, located at depths of 410 km and 660 km. The two discontinuities in the mantle are formed by pressure-induced phase transformation of the olivine which is the main component mineral of the mantle, from olivine to spinel at 135,000 atm. pressure, which corresponds to a depth of 410 km, and spinel to perovskite and rock salt structure under a pressure of 235,000 atm., which corresponds to a depth of 660 km. However, the pressure triggering the latter post-spinel transformation has not been determined precisely, because quench method used in earlier experiments is based on indirect pressure calibration.

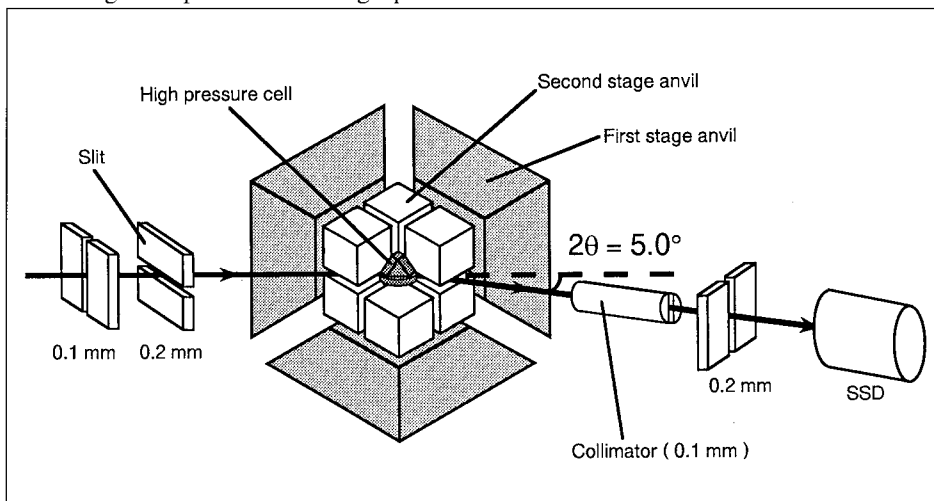
The present research determined the phase transformation pressure by concurrently performing phase observation under high temperature and high pres-

sure using X-rays and the measurement of changes in the volume of gold used as the pressure marker.

The high-temperature, high-pressure experiment used a specimen of olivine (Mg_2SiO_4) powder mixed with gold powder as the pressure marker. Pressure was applied to the specimen by increasing the press load, and after the specified pressure was attained, the temperature was increased while maintaining a constant load. The generated pressure was calculated by estimating the change in the volume of gold from diffracted X-rays and using the equation of state. Experiments were conducted by varying the pressure and temperature conditions, and the obtained X-ray diffraction patterns were used to identify the phases present as well as the pressure values with high accuracy. The spinel to post-spinel transformation boundary determined was quite different from that measured previously. The mantle temperature near the 660 km discontinuity surface was estimated at around 1600°C,



Multi-anvil high-pressure device (SPEED-1500)



Optics for X-ray in situ observation using multi-anvil high-pressure device (SPEED-1500) at SPring-8

and the phase transition pressure was located at about 210,000 atm. This value is more than 20,000 atm. lower than the results of quench method experiments in the past (about 235,000 atm.) This inconsistency suggests the pressure of the spinel to post-spinel transformation may be increased greatly by the presence of another element such as iron present as

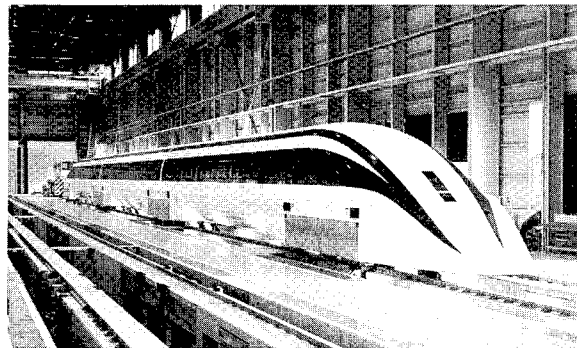
10 mol% Fe_2SiO_4 . This area needs further study through experimentation. On the other hand, the 660 km discontinuity may not be caused by the spinel to post-spinel transformation as believed previously, but could be a discontinuity caused by some change in chemical composition. Therefore, conventional knowledge could be completely revised.

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World's Fastest Speed Recorded by Superconducting Magnetically Levitated Linear Motorcar

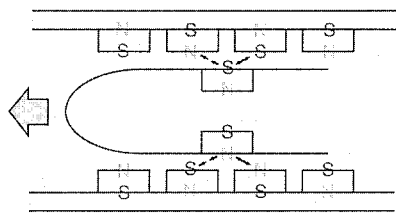
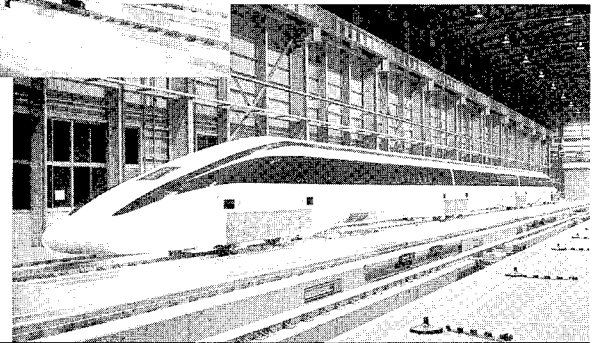
Railway Technical Research Institute and Central Japan Railway Company (JR Tokai) have conducted a running experiment of a superconducting magnetically levitated linear motorcar on the Yamanashi Maglev Test Line (with 7 passengers), and recorded the world's fastest speed of 531 km/hr. The research team also attained the world's fastest speed of 550 km/hr without passengers.

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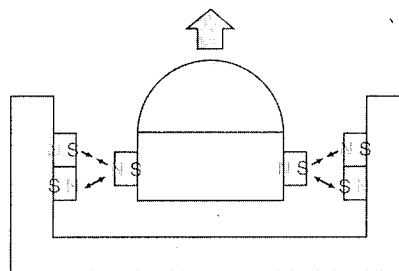


Leading car (Aero wedge type)

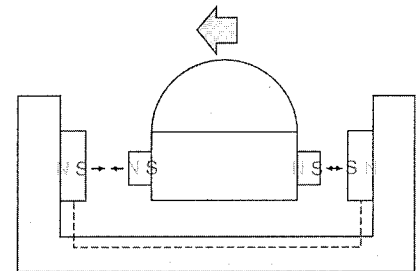
Leading car (Double cusp type)



By passing current through propulsion coils on the ground, a magnetic field (north and south poles) is produced, thus the train is propelled forward by the attractive force of opposite poles and the repulsive force of same poles acting between the ground coils and the superconducting magnets built into the vehicles.



When the superconducting magnets on the vehicles pass through at high speed, current flows through levitation and guidance coils on the ground, producing electrodynamic levitating force on the vehicles.



The levitation and guidance coils on either side are connected with electric power cables. They keep the vehicles in the center of the guideway at all times by exerting an attractive force on the farther side of the vehicle and a repulsive force on the nearer side should the train move off center to either side.

NATIONAL R&D PROJECTS

This section describes various R&D projects being carried out in Japan on a national scale.

** Agency of Industrial Science and Technology, MITI
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National Research and Development Programs for Medical and Welfare Equipment (2)

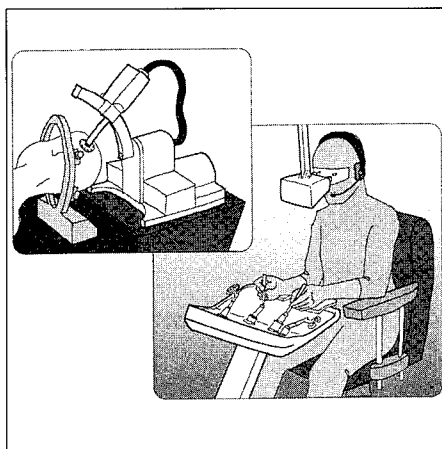
3. Projects to Develop Low-Invasive Surgical Operation Support Systems (Therapy Sector)

Because of the need to establish therapy systems of least burden to patients, low-invasive surgical operation support systems will be established to enable precision therapeutic operations such as incisions, removal and joining of diseased and injured joints, cerebral tissue, liver, heart and further micro blood vessels and nerves by guiding micro manipulators very accurately while acquiring image information with X-ray CT and MRI. Research will be advanced to establish surgical support systems which are less invasive for treating deep tissue diseases, while following progress in related research and development.

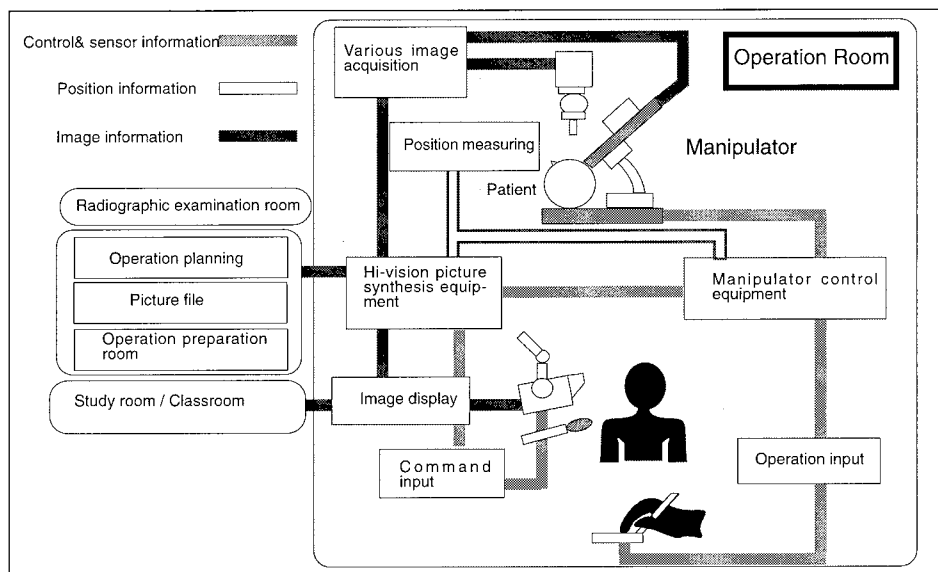
1) Support System for Brain Tumors and Other Surgical Operations

For complex surgeries of brain tumors and other diseases in which the tissue has

extremely small structures, a system will be established to provide stereoscopic images of the afflicted parts provided by a photographic system which will permit precision treatments such as incisions, removal and joining with micro manipulators (FY 1995-2009).



Conceptional drawing of the completed system



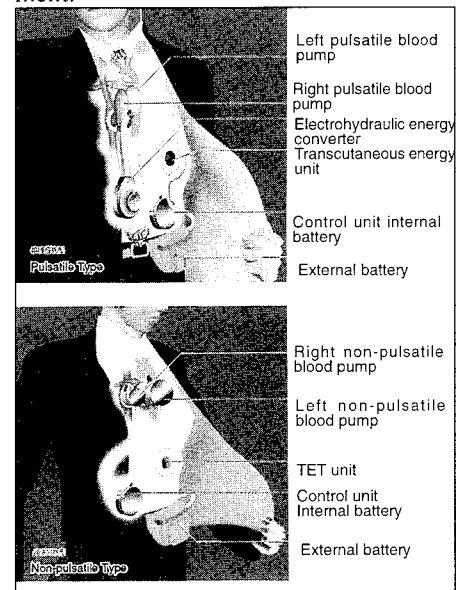
Schematic diagram of the system

2) Ultrasonic Therapy System

Research is in progress to establish an ultrasonic therapy system that combines the focal spot system and a higher harmonics superpositioning system that limits the treatment targets to tumor tissue and destroys tumors effectively by non-invasive treatment (FY 1998-2012).

4. Artificial Heart Technology Developmental Project (Functional Proxy Sector)

To respond to internal organ replacement needs, various types of artificial internal organs will be developed based on the advance of related technologies such as biocompatible material technology, micromachine technology and biotechnology. More specifically, more compact, higher performance biocompatible artificial organs will be developed using the advances in related research and development.



Conceptional drawing of the completed system

1) Implantable Total Artificial Heart System (Clinical Pre-Chronic Animal Experiments)

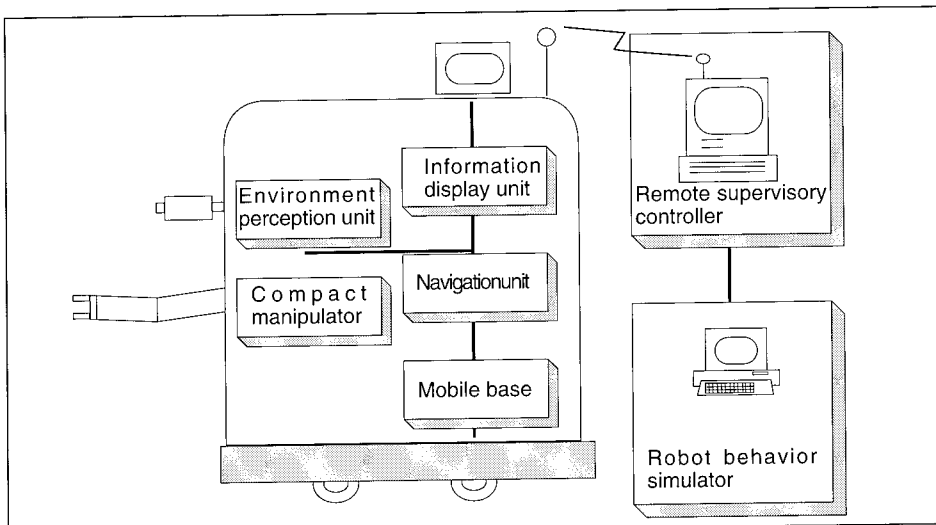
To save and permit social restoration of end-stage cardiovascular patients, an implantable total artificial heart system that is biocompatible, compact and highly reliable will be developed, and for the initial step, a pulsatile type and a continuous (non-pulsatile type) will be developed to gain a technical outlook on the feasibility of development. (FY 1995-2009)

5. Human Friendly Nursing Support Intelligent System Developmental Project (Autonomous Nursing Support)

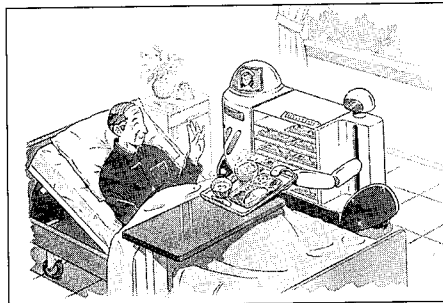
To respond to the rapid increase in the number of patients demanding nursing and the decrease in the young labor population, also to establish human friendly nursing systems, research is being advanced to develop intelligent systems designed to alleviate the burdens of carers and promote self-care, based on the progress achieved in robotics and electronics technologies. Essentially, intelligent systems will be established to support the advanced actions of patients requiring nursing using progress achieved in related fields.

1) Robot for Carrying Food Trays to the Aged and Disabled

Under development is a robot system featuring conveyance item recognition, manipulation and autonomous transfer of food trays and added safety, and which is also capable of communicating with carers, to permit the delivery of food trays and other non-personal tasks to be performed with a robot system to free carers to direct attention on more personal patient needs (FY 1994-2008).



Schematic diagram of the system



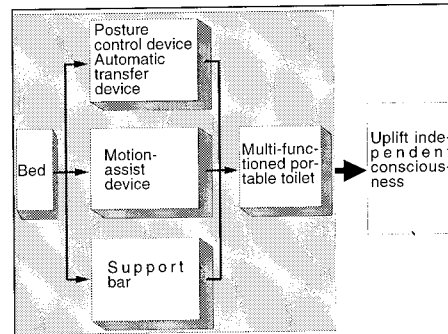
Conceptual drawing of the completed system

6. Projects to Develop Home Welfare Equipment and Systems (Home Welfare Sector)

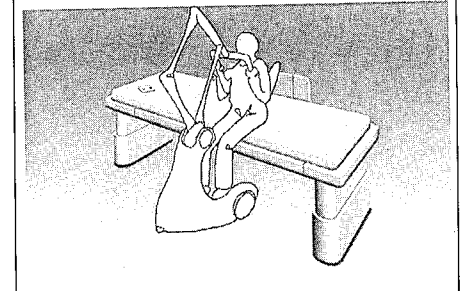
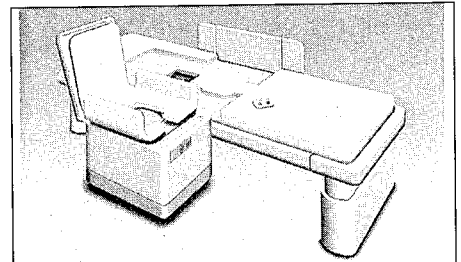
In response to the increasing role of in-home welfare into the future, Welfare Technohouses established in 13 regions throughout the country are being utilized to develop support systems and equipment designed to support in-home mobility, excretion, bathing and other activities of elderly persons, which consider the interfaces between the users and the systems and equipment.

1) Autonomous Excretion Support System

Research is in progress to develop a portable toilet with a lukewarm water washing function, forced deodorization function and easy disposal function, as



Schematic diagram of the system

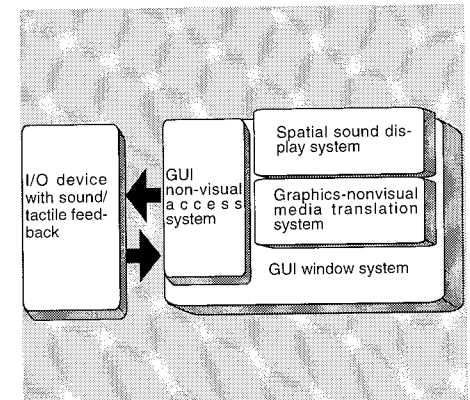


Conceptual drawing of the completed system

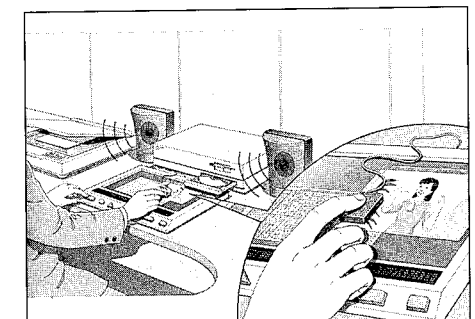
well as a system to support the autonomous excretion as well as the movements of elderly persons from the bedside to the toilet (FY 1993-2008).

2) Multimedia System for the Visually Handicapped

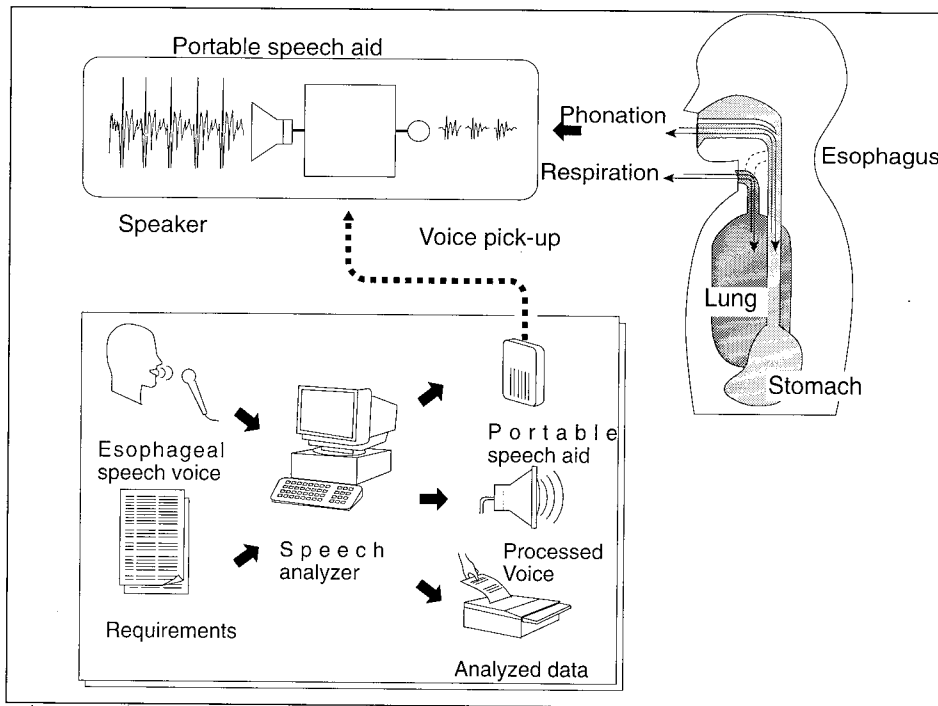
Development of a multimedia access support system that enables visually handicapped persons to get easier access to applications software in general in a graphics user interface (GUI) precluding the processing of visual information (FY 1994-2008).



Schematic diagram of the system



Conceptual drawing of the completed system



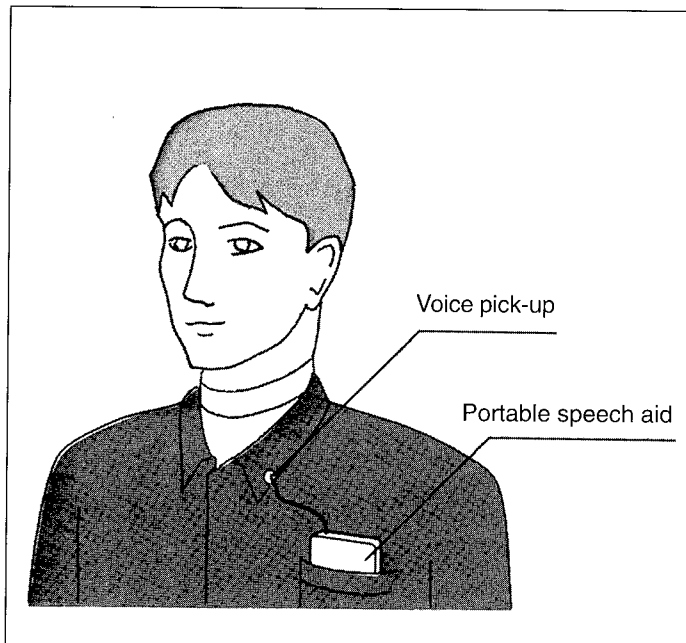
Schematic diagram of the system

7. Esophageal Vocalization Aid System

To support persons using esophageal vocalization because of the loss of vocal cords due to laryngeal cancer or some other cause, a system is under development that picks up the sounds generated by the esophagus, then converts and amplifies these sounds into easily articulated speech to permit communications even under the most difficult situations (FY 1994-2008).

8. Comprehensive Support System for Wheelchair Design and Operation

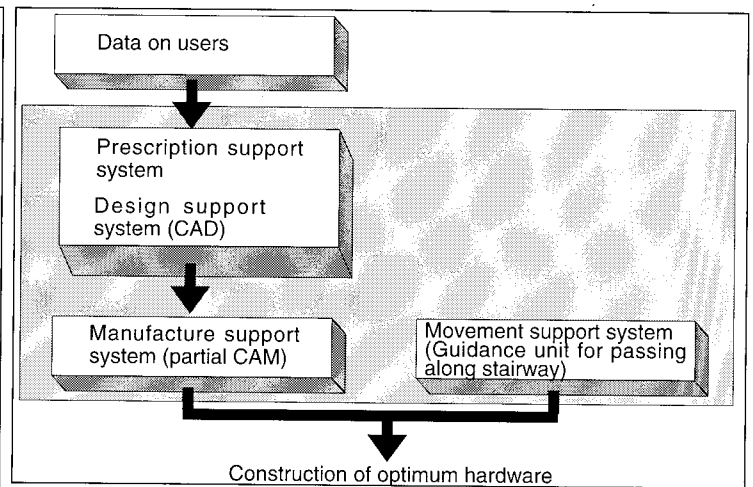
A system to support the design and manufacture of wheelchairs, or the commercialization of a moderately priced space conservation type stairway ascending/descending system featuring excellent maneuverability (FY 1993-2008).



Conceptual drawing of the completed system

3) Esophageal Vocalization In-Home Aid System

To cope with aphasia (loss of vocal cord function) caused by cerebral hemorrhage or by traffic accidents, research is in progress to develop a multimedia assist system that appeals to the integrated use of human senses including hearing, visual and touch senses to structure vocal language with the brain and to develop a multimedia system that enables rehabilitation in conformance with the state of aphasia (FY 1998-2010).



Schematic diagram of the system



Conceptual drawing of the completed system

GENERIC TECHNOLOGY REVIEW

Electronics : Research of Electron-Number-Controlling Devices

Electronics: Research of Subpicosecond Devices

This section describes various basic research and development activities in Japan to inform the world about generic R&D efforts here.

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Electronics : Research of Electron-Number-Controlling Devices

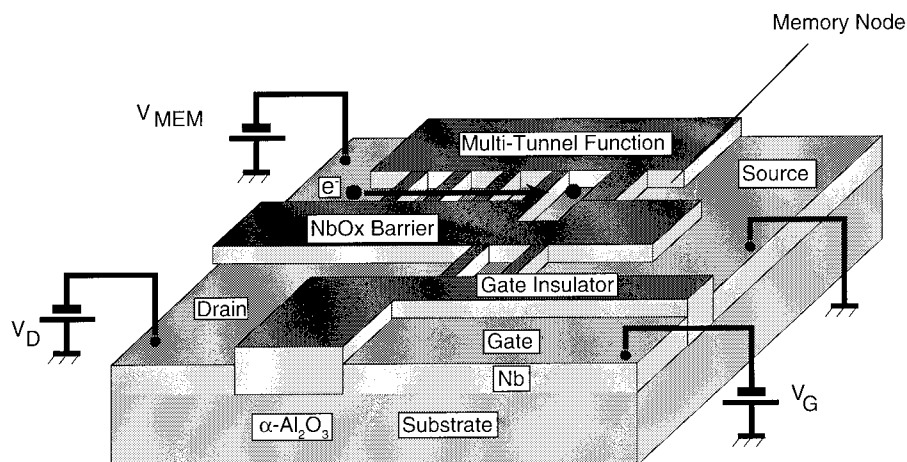
Electrotechnical Laboratory

Goal: The silicon semiconductor devices such as a memory circuit or computing unit are the key elements for the computer which is essential tool for the present society. The size of the semiconductor devices is approaching to 0.1 micrometer with the development of the small size fabrication technology. Using

the present technology, however, it is said that the limit of the device size is 0.1 micrometer. Therefore, a new technique which breaks through this limit is required.

Approach : For the development of the new ultra high integration circuit, a new fabrication process which uses the ultra-vacuum chamber, all fabrication processes are performed inside this chamber must be developed instead of using the conventional clean room process. Using these new fabrication process, the following researches are considered.

- 1) Ultra-thin silicon active layer of 10 nm will be formed on an insulator as a fundamental technique of the next generation devices .
- 2) Ten times smaller size MOS devices than the conventional device will be developed and the characteristics are examined.
- 3) New tunneling with the tunneling barrier width of 1nm will be investigated using the computer simulation.



Structure of Single Electron Memory

Goal: As our society moves toward the integration of all local activities into one large communication network, the demand for the wider communication channel and, in turn, faster signal processing devices increase. This project aims to contribute the establishment of the infrastructure of device technologies which is necessary to the ultrafast signal processing devices.

Our aim is to build a measurement system of electromagnetic wave around 1 THz to facilitate the understanding of the device behavior in this region.

Approach : We first start to develop electromagnetic-wave emitter in the THz-region, or 0.1 to 10 THz region. One of the devices is called the Auston switch, where electric signal is generated on a transmission line by irradiating an ultrashort light pulse on its metal gap.

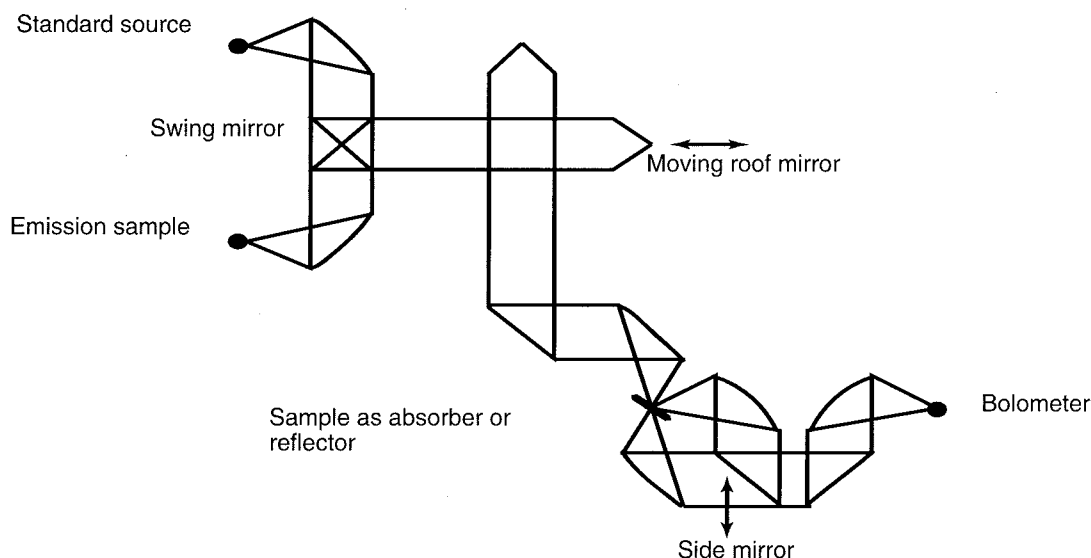
Generation of short (380 femtosecond or about one three-trillionth second) and significantly high (over 4V) electrical pulses have been achieved by our group. Understanding the detailed mechanism of signal generation for this device will be necessary to further shorten the signal width and, more importantly to suppress or tailor the tail of the pulse which is not, at present sufficiently small.

At the same time we will start to build a spectrometer, an apparatus which accepts a signal composed of many frequencies and determines what amount of energy resides in every frequency, for electromagnetic wave of 60 GHz to 18 THz, with a high-sensitivity region of 100 GHz to 5 THz or wider. The frequency of 60 GHz is slightly lower than the upper limit that the conventional network analyzer, a piece of apparatus which analyze the signal spectrum between two points of an electrical circuit, can handle. The frequency 18 THz is slightly higher than the lower limit that conventional spectrometers can handle. This spectrometer thus bridges these two frequency regions and our ability of spec-

trometry widens from zero Hz to ultra violet or farther.

Our primal activity is to build the spectrometer in the first year, and to measure the various electromagnetic wave emitters by using it in the succeeding years. We also prepare an environment as an open measurement site, and will accept activities of other groups for measurements of emission, absorption or reflection by various devices and materials.

Background : We already participated in a project named femtosecond technology when ultrafast signal processing technology is of primal importance. During the course of the research, we confronted a fundamental problem that the coupling of electrical signal in a circuit and the electromagnetic wave in free space is significantly strong. Thus we concluded to build the technology infrastructures for the measurement of the electromagnetic wave in THz region. Since it should be available for all who are interested in this frequency region, we decided to start a project independent from the former one.



A schematic diagram of far-infrared Fourier spectrometer for electro-magnetic waves of 60 GHz to 18 THz, with a higher-sensitivity region of 100 GHz to 5 THz or wider. The spectrometer fills a gap between two frequency regions for which spectrometers are more easily available.

High-Tech INFORMATION

May
1998

98-05-100-01

Technique for Analysis of Arch Dam Soundness

The Abiko Laboratory of the Central Research Institute of the Electric Power Industry has established a technique to analyze the soundness of arch dams. The state of deformation of the dam concrete structures which undergo a change due to the action of the temperature and variations in water storage level is computed in detail, and a distinct advantage of the new technique is its capacity for assessing the forces acting on the joint parts of these structures. Therefore, it is now possible not only to evaluate the deformation occurring in the concrete structures but also to assess the fine cracks generated on the surfaces of these structures.

The structure of an arch dam that dams up a river generally assumes an arched, curved shape with several joints running vertically. Since the structure is fabricated with concrete blocks, joints are provided between the blocks which serve as a cushion. The analysis technique established by the research institute assumes these joint parts as springs and computes the changes occurring on the entire structure by measuring the influences acting on these joint parts.

Compared with the conventional method of computing the entire structure as a mass without joints, the new technique enables analysis will be performed much more accurately in conformance with the real state of the structures. The measured values and the computed values have been confirmed to generally congrue, even with respect to some deformed parts of which analysis had been impossible before.

The research institute plans further research to establish a technique to conduct analysis on the estimated states when some unexpected force acts on these dams, such as an earthquake.

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98-05-100-02

Industrial Robot for Chamfering Holes on Free Curved Surfaces

Prof. Y. Takeuchi and his research team of the Faculty of Electro-Communications, University of Electro-Communications, have devel-

oped a system to chamfer holes of irregular shapes on free curved surfaces with an industrial robot. This chamfering system using CAD data requires little time and labor for programming by teaching, and experiments fully corroborated that it chamfers holes in curved surfaces reliably as instructed.

The system consists of a vertical multi-articulated, hexagonal-axes control robot available on the market, a chamfering rotary tool mounted at the tip of the robot arm, a worksta-

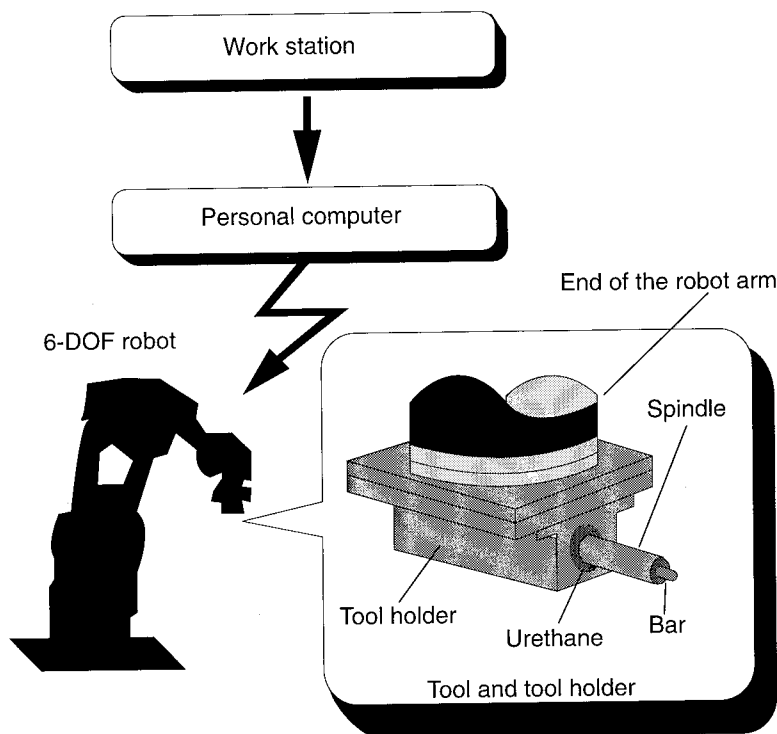


Fig.1 Configuration of the system

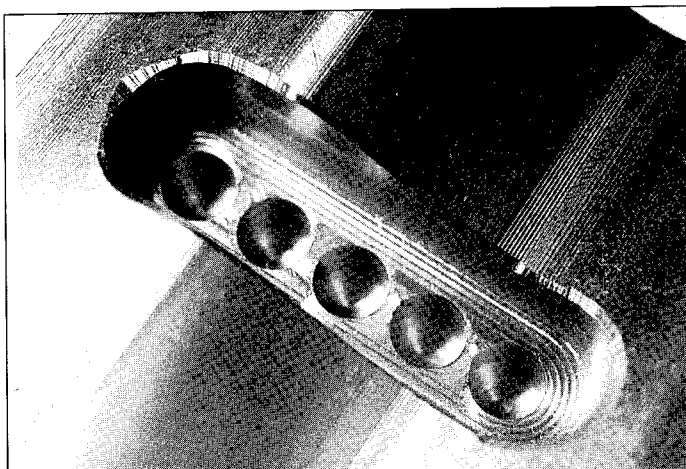


Fig.2 Workpiece after deburring

tion to provide a CAD system, and a personal computer that prepares motional programs. For the work flow, surface information relating to the workpiece is derived from the CAD data, and the tool path is determined by utilizing the surface information and considering the tool position and attitude. Subsequently, matching is performed by converting the workpiece coordinate system into the robot coordinate system, after which the motional program is prepared for a representation of the robot intrinsic attitudes.

When chamfering with a robot, it will be necessary to perform transits while treading over a continuous track with the designated attitude. However, when relying simply on the tool course based on surface information, there is the problem of the motional range being exceeded, making it difficult to assume the designated attitude. In the research, the method was adopted of determining the tool direction by using the initial-stage tool vector that corresponds to the tool axis vector and the temporary tool direction vector, as well as the target

point tool direction vector, to enable tool transit without the arm deviating from its motional range.

In experiments, holes were drilled into a piece of metal with slate-like curve, and chamfering at 45 degrees was accomplished successfully along a machining ridgeline formed with the system, without having to rely on teaching.

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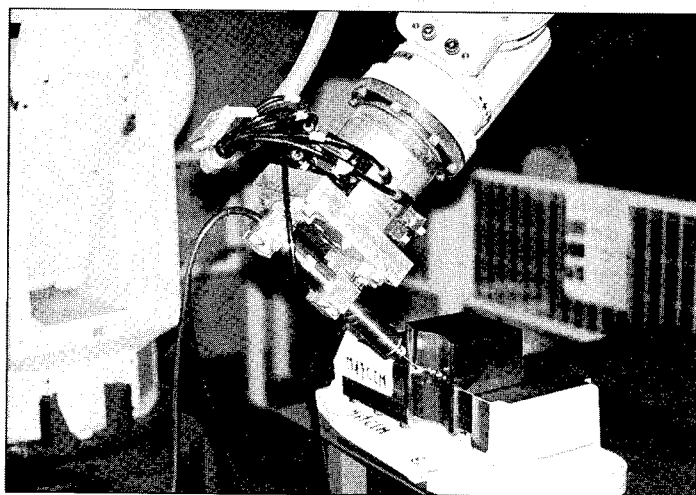


Fig.3 Robot performing deburring

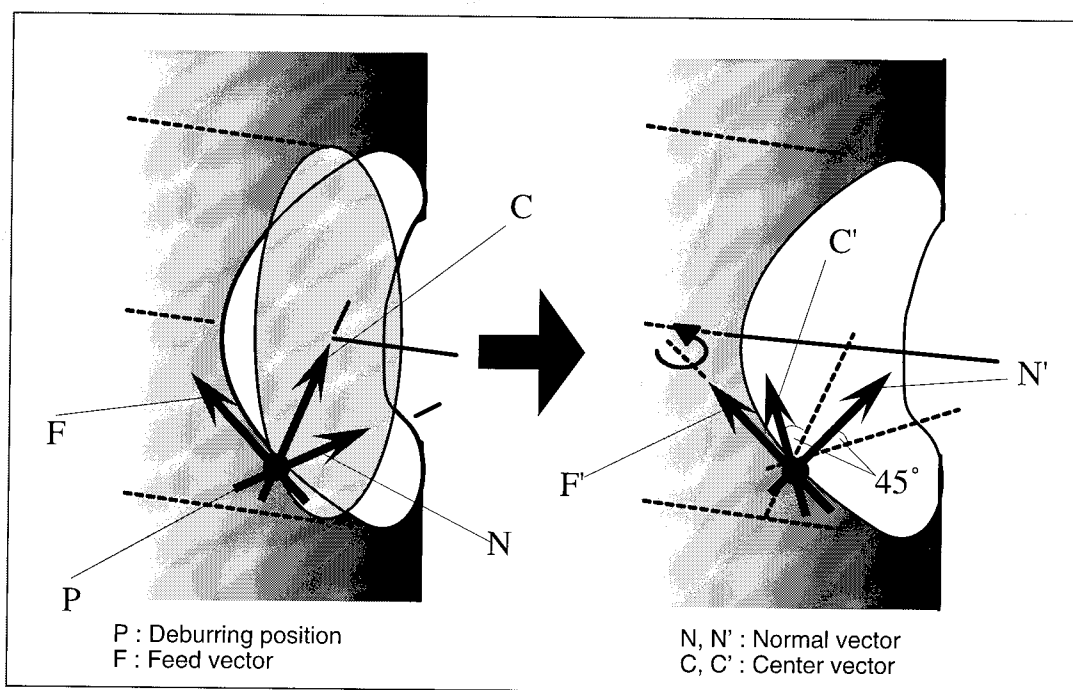


Fig.4 Generated deburring path

NEW TECHNOLOGY & PRODUCTS

This section provides information about recently developed technologies and products, divided into Advanced Materials, Electronics & Optics, Information & Communications, Process & Production Engineering, Construction & Transportation, Energy, Environment, and Biotechnology & Medical Science.

Advanced Materials

98-05-001-01

Superconductive Thin Film Material for Electronic Devices Usable at Temperatures of Over 100 K

Superconductivity Research Laboratory, International Superconductivity Technology Center has developed a copper oxide superconductive thin film material for electronic devices that is usable at temperatures of over 100 K. Also, with the cooperation of Hitachi, Ltd. Basic Research Laboratory, a prototype superconductive quantum interference device (SQUID) was made and succeeded in demonstrating excellent performance including operation at a liquefied natural gas temperature of 110 K.

Recently, research has been advanced intensively to develop electronic devices such as SQUID magnetic sensors and microwave wireless communications filters which are made of copper oxide high-temperature superconductive materials. Incidentally, the superconductive thin film materials used for fabricating these devices

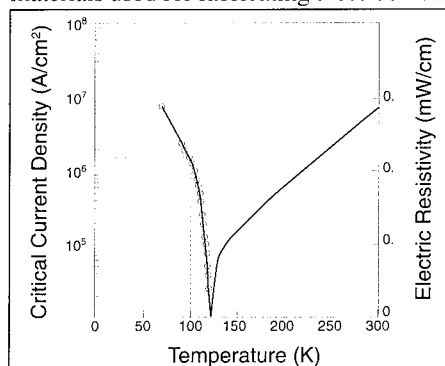


Fig. 1 Temperature dependence of the electrical resistivity and critical current density of the mercury-based high-temperature superconductive thin-film material developed this time

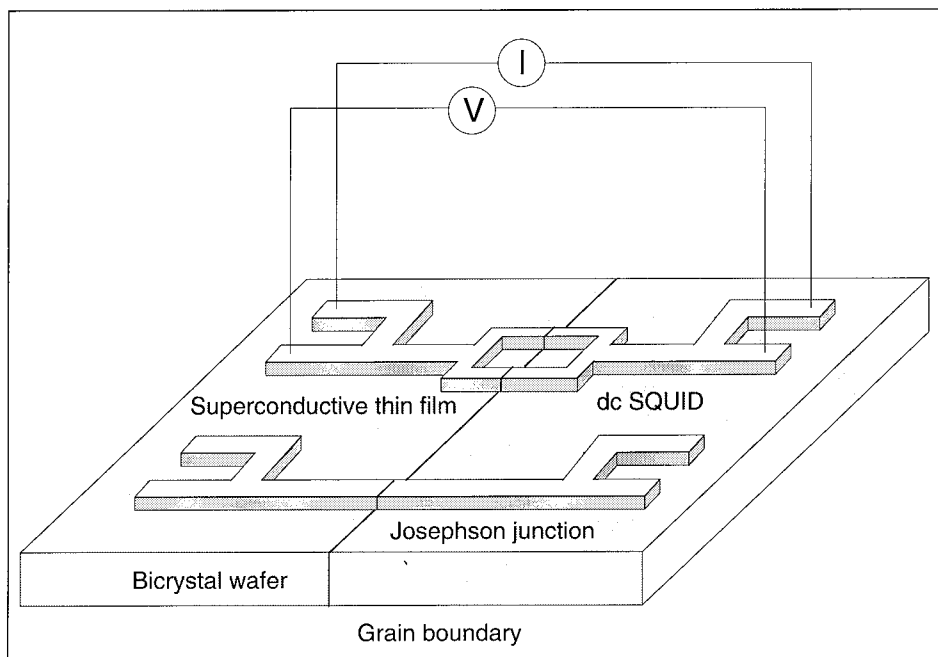


Fig. 2 Model diagram of a Josephson junction and dc SQUID fabricated on a bicrystal wafer.

are primarily made of yttrium (Y)-based materials with a critical temperature (T_c) of 93 K. Materials with higher critical temperatures than yttrium-based materials are the thallium (T)-based materials ($T_c = 110, 127$ K) and the mercury (Hg)-based materials which have the highest critical temperature ($T_c = 128, 136$ K) among copper oxide materials, but these materials contain readily volatilized elements, making it difficult to produce thin films of excellent properties or featuring a high degree of crystallinity and smooth surfaces indispensable for fabricating thin films with the characteristics necessary for producing quality devices, so devices with character-

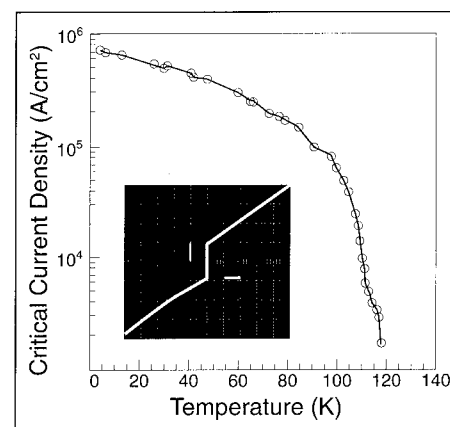


Fig. 3 Temperature dependence of the Josephson junction critical current density and the current-voltage characteristics at 103 K

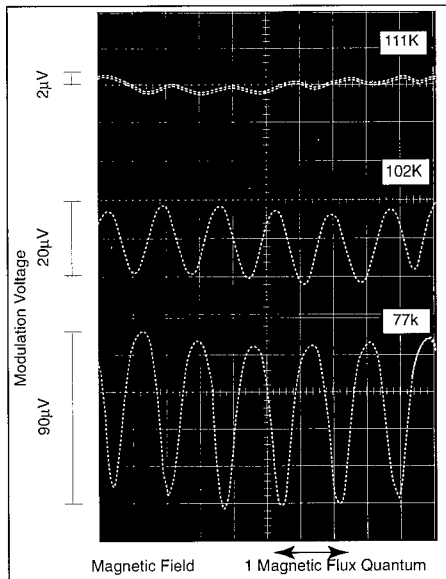


Fig. 4 Scanning electron microscope photo of the fabricated dc SQUID

istics surpassing those made of yttrium-based materials had not been available.

The Laboratory had been advancing research to synthesize mercury (Hg)-based superconductive materials, and attained the world's highest level of critical temperature (136 K) in ceramic materials, but the research optimized the thin film structure by adding elements which stabilize the crystalline structure, and studied optimizing the heat treatment conditions by applying technical expertise accumulated through past synthesis of ceramics, and succeeded in the fabrication of a Hg-based thin-film material featuring a high degree of crystallinity, smooth surface and excellent superconductivity by the laser sputtering technique. The thin film obtained had a critical temperature of 122 K and a high critical current density of over 1 million A/cm² at 100 K.

This thin film was fabricated on a strontium titanate (SrTiO₃) bicrystal wafer, and an ultrafine pattern with a line width of 2-10 nm was fabricated by the electron beam lithography and dry etching process at Hitachi Basic Research Laboratory. With this thin film, the Josephson junction characteristic was observed at high temperatures of up to 119 K. Further, when a dc SQUID containing two of these Josephson junctions was fabricated, the device performed satisfactorily up to a high temperature of 110 K (temperature of liquefied natural gas). IBM earlier reported the performance of a SQUID made of Hg-based

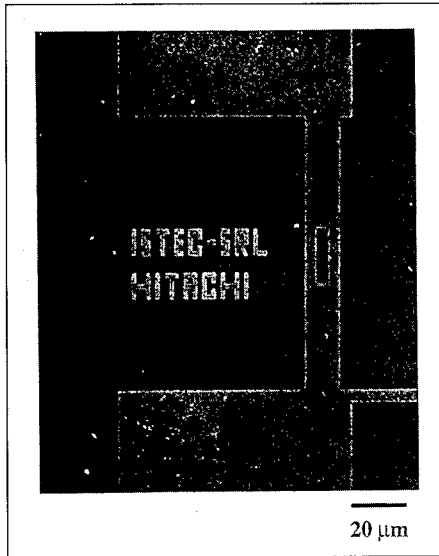


Fig. 5 Periodic changes in the voltage when a magnetic field is applied to the SQUID

material at over 100 K, but the SQUID fabricated this time had characteristics such as the IcRn product and the modulation voltage amplitude are more than five times better compared with before. It was also confirmed to display an IcRn product of over 460 mV, about double that of the SQUID made of Y-based materials, at the liquid nitrogen temperature (77 K). This is the first time that device characteristics have been demonstrated which surpass those of devices made of Y-based materials.

The SQUID made of high-temperature superconductive thin film is presently under intensive study for application to the non-destructive inspection of aircraft and other structural materials as well as a SQUID microscope that is ideal for biological observations, and the successful development of the superconductive thin film material will also enable load reduction of cryocoolers as well as the reduction of extraneous heat inflows, so is anticipated to have a tremendous impact on future SQUID applications. Further, the thin film material developed this time has a high potential for featuring excellent characteristics as a material for microwave devices, so it is expected to be used in a wide range of applications.

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98-05-001-02

Superplastic Compressive Deformation Process for Strengthening and Toughening Technology of Silicon Nitride

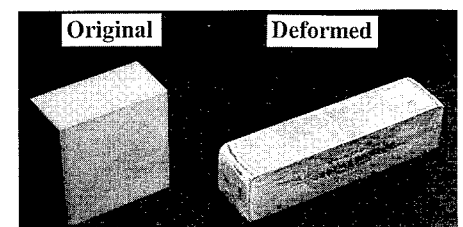
The National Industrial Research Institute of Nagoya has developed a hardened and toughened silicon nitride processed using the superplastic deformation process.

In conventional silicon nitride, the rod-shaped grains are randomly oriented, resulting in an isotropic microstructure. Alignment of the grains is expected to provide higher bending strength and fracture toughness in specific directions.

The institute recently demonstrated the superplastic tensile deformation of silicon nitride, into a highly anisotropic microstructure, in which rodlike grains were aligned along the tensile direction.

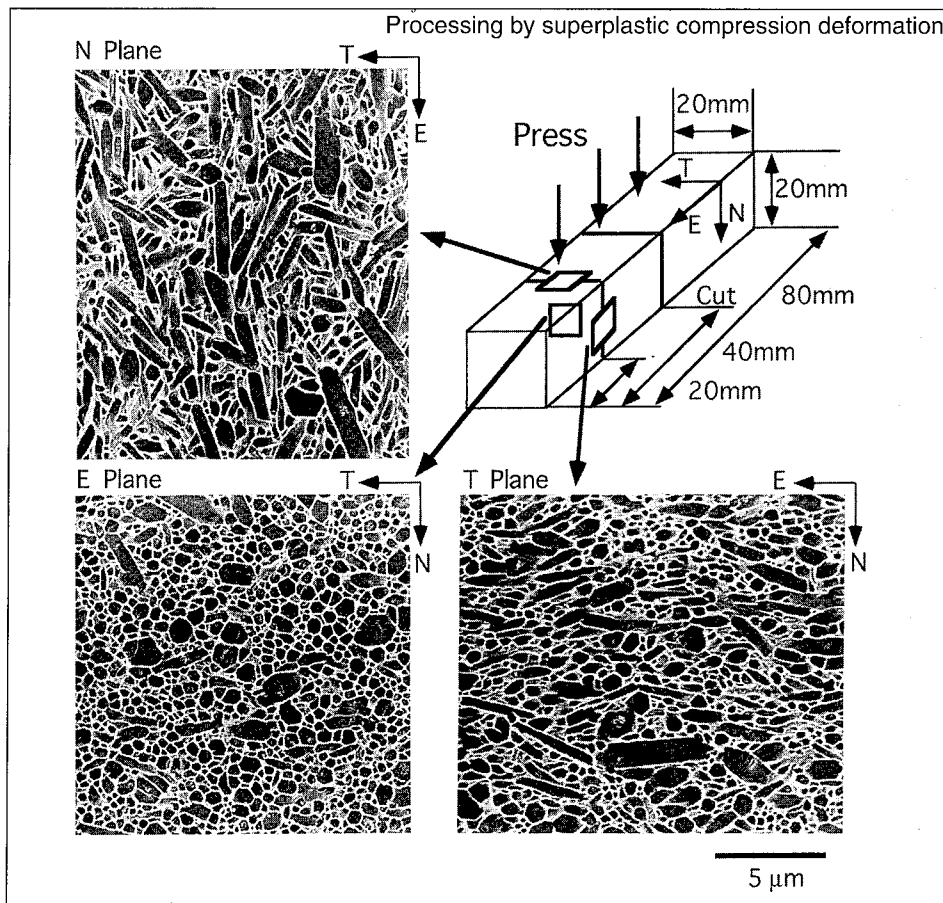
Silicon nitride with an anisotropic microstructure can also be obtained by superplastic plane-strain compressive deformation.

This latter method is advantageous for providing testpieces of large dimensions from which a sufficient number of mechanical testpieces can be obtained



Original and superplastically deformed silicon nitride
(Left: original, right: plastically deformed)

A silicon nitride testpiece was prepared by gas-pressure sintering with Y₂O₃ and Al₂O₃ additives. Chemical analysis revealed 3.7 wt% Y, 1.7 wt% Al, and 3.5 wt% O. The density was 3.262×10^3 kg.m⁻³. The original testpiece of 40 mm × 40 mm × 20 mm was plane-strain deformed superplastically in a graphite channel die under a pressure of 5,000 kg applied for 3 hours at 1,750°C. The superplastic compressive deformation resulted in 50% height reduction, and the dimensions of the obtained testpiece were 980 mm length, 20 mm height, and 20 mm width. The density of the deformed silicon nitride was 3.265×10^3 kg.m⁻³. No cracking was observed



Microstructure of deformed silicon nitride

on the surface of the deformed silicon nitride which consisted of B-silicon nitride grains without a-phase.

The three-point bending strength were increased to 1650 MPa from 1100 MPa and fracture toughness from 8.5 to 13 MPa.m^{1/2} by the deformation process when a stress was applied in the extrusion directions. Thus, both strength and fracture toughness were increased 1.5 times over

those of conventional silicon nitride.

The institute announced that these improvements were mainly due to effective operation of grain bridging and pull-out by grain alignment.

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Today, due to the progress being achieved in mobile communications, satellite communications and wireless local area network (LAN) communications, the use of electromagnetic waves is shifting toward ever higher frequencies, and expanding the utilization of GHz-band electromagnetic waves. At the same time, the deterioration of electromagnetic environments by electromagnetic wave interference is feared and, as a countermeasure, it has become necessary to develop an electromagnetic wave absorber capable of working in the GHz-band.

The research team directed its attention on the magnetic resonance that occurs between a magnetic substance and its magnetic wave, and succeeded in developing a GHz-band electromagnetic wave absorber covering a broad frequency domain not coverable by its conventional counterparts. Normally, the magnetic resonance phenomenon occurs with ferrite magnets at a frequency of about 50 GHz. The frequency at which this occurs can be controlled and shifted to the lower frequency domain or higher frequency domain by controlling the composition of the ferrite magnet. Based on this observation, it was discovered that GHz-band electromagnetic waves can be absorbed effectively by optimizing the electromagnetic wave absorption characteristic of the ferrite magnet composition.

The composition of the electromagnetic absorber developed this time is essentially an alloy consisting of substances such as iron oxide and barium. A ferrite magnet sintered body containing titanium and manganese reportedly enables the design of an electromagnetic wave absorber workable in the frequency bands of 10-50 GHz with a thickness of 1 mm. Also, by crushing this sintered body and mixing with a resin, an absorber with a thickness of 1-3 mm can display a wideband electromagnetic wave absorbance of over 99% (specific bandwidth of over 45%) in the frequency band of 8-20 GHz.

Incidentally, the conventional type of electromagnetic wave absorber primarily consisting of magnetic core materials such as spinel type ferrite or ferrous alloys could cope only with frequencies of up to about 10 GHz at best.

The Electromagnetic Compatibility Research Laboratories Co., Ltd. was estab-

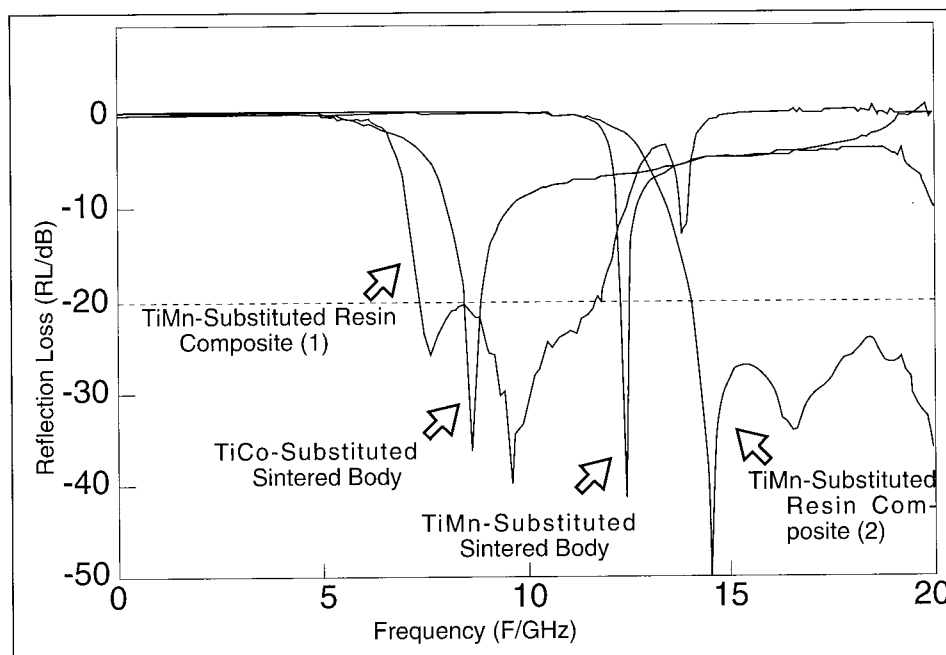
Electronics & Optics

98-05-002-01

GHz-Band Electromagnetic Wave Absorber Utilizing Ferrite Magnet

Electromagnetic Compatibility Research Laboratories Co., Ltd. (EMC Lab.) and Prof. M. Homma of the Graduate School of Engineering Research, Tohoku University, have jointly developed an electromagnetic wave absorber that is workable in the microwave GHz band. It is an application of the magnetic resonance

phenomenon of the ferrite permanent magnet, and has been confirmed to be workable effectively up to about 30 GHz, a radio wave band that is three times that of conventional types of electromagnetic wave absorbers. The ferrite magnet is inexpensive and can be mass produced, so has potential as a most convenient tool for the commercialization of a GHz-band electromagnetic wave absorber.



lished in 1996 through joint investment by the Basic Technology Research Promotion Center of the Ministry of International Trade and Industry and 24 private enterprises. The development of the new electromagnetic wave absorber is the company's first joint research performance since its establishment.

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98-05-002-02

Highly Sensitive and Selective Circular Dichroism (CD) Detector for High-Performance Liquid Chromatography (HPLC)

JASCO has developed the model CD-995 chiral detector dedicated to HPLC. It is an innovative detector that offers higher sensitivity for chiral compounds with more information than a conventional optical rotation (OR) detector.

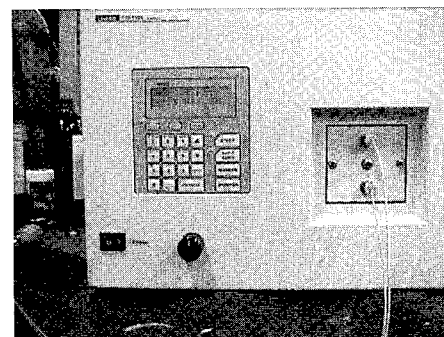
Chiral separation is now one of the most important application areas in HPLC. There is increasing demand for chiral chromatography in various fields, such as drug analysis, drug discovery, biochemical analysis, natural product analysis, organic synthesis, etc. Recent advances in chiral column technology are boosting the use of chiral chromatography in more and more laboratories. Advances in chiral detection tech-

nology, however, have not yet met these advances in terms of sensitivity and selectivity. The new CD-995 detector is expected to meet the requirements.

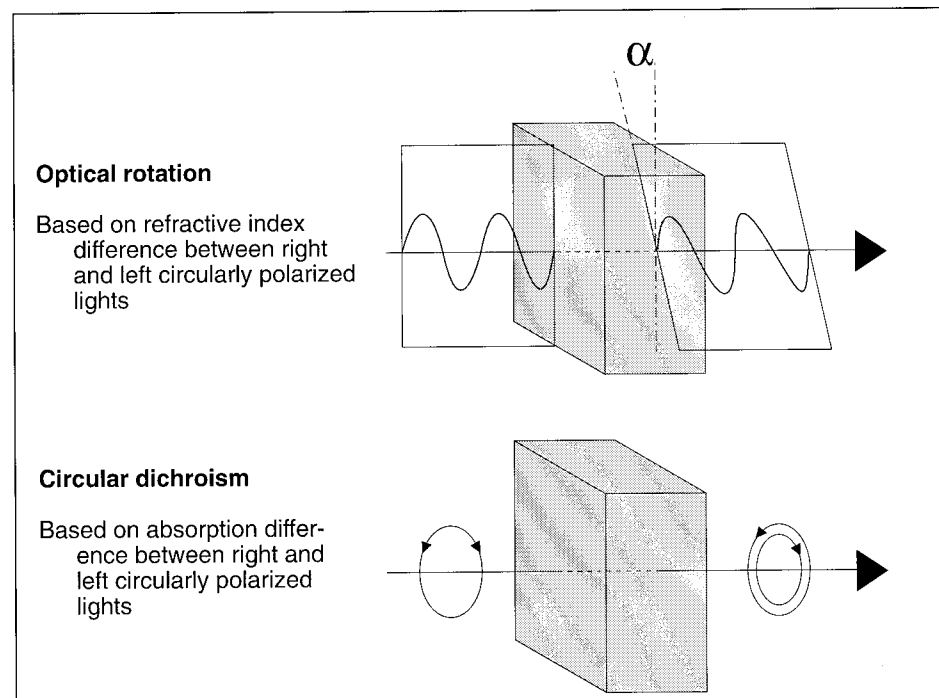
OR detectors have exclusively been used for detection of chiral compounds, though it is known that a detector based on circular dichroism may offer better sensitivity. Therefore, a lot of efforts have been made to utilize a regular CD spectropolarimeter, which is rather big and expensive, as an HPLC detector. After extensive R&D

work, JASCO has successfully developed a compact CD detector dedicated to HPLC that offers simultaneous detection of CD and UV absorption, and even CD and UV spectral measurements by stop-flow scanning.

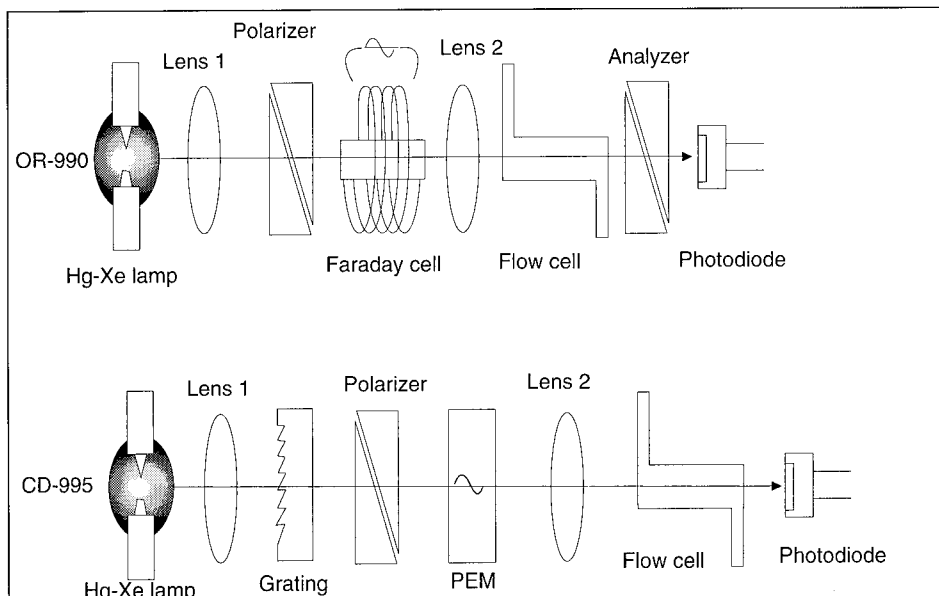
Most biologically active compounds are chiral. It is well known that chiral isomers often cause totally different biological effects, e.g., one offers therapeutic effects but the other has unwanted effects such as teratogenic activity. Most naturally occurring medicines contain only one type of the isomers. However, when such a compound is artificially synthesized, both isomers are, in general, equally produced. Therefore, each isomer must be examined for its biological activity. In such investigation, a conventional CD spectropolarimeter has been effectively used. In order to analyze samples with the CD spectropolarimeter,



CD-995 chiral detector



Optical rotation and circular dichroism phenomena



Optics of OR-990 and CD-995

chiral separation needs to be performed and each isomer must be fractionated. The new CD-995 detector offers on-line monitoring of CD signals during chiral separation and gives indication which peak components should be collected. In addition, the simultaneous CD and UV monitoring by the detector can determine the optical purity of unresolved peaks of chiral compounds. This allows researchers to speed up their investigations and new drug discovery.

*** JASCO International Co. Ltd.**

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Tokyo 198-0835
Tel: +81-426-65-1322
Fax: +81-426-65-6512

98-05-002-03

PIC Mounted PCB for Sequencer

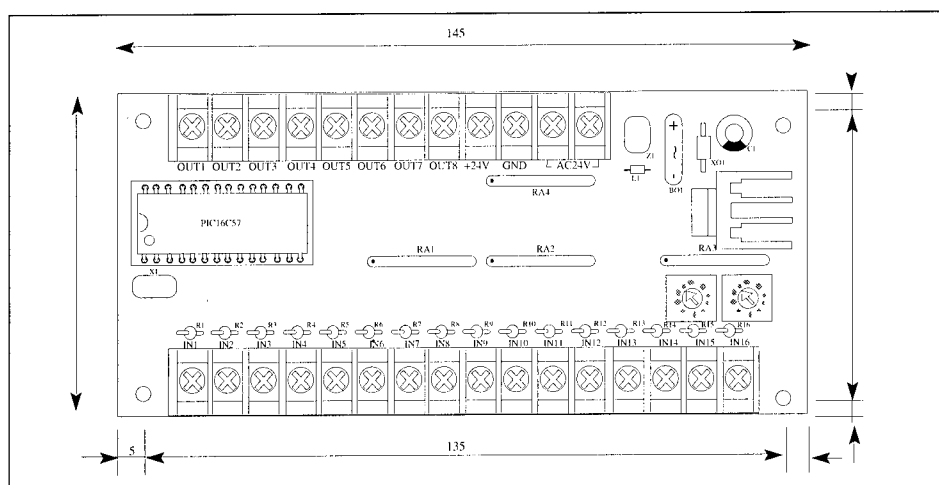
ASIC Co., Ltd. has developed transistor output one-board type printed circuit

board (PCB) for sequencers using the PIC, a low priced CPU developed by Microchip of the U.S.A. There are two types of PIC mounted PCB, with LED or without LED. This PCB can control a total of 24 points, 16 points for input and 8 points for output, and is equipped with a terminal table for easier mounting onto other electronic devices, and has features to shorten the development period of the programs. The price is ¥9,500, which is about one-third of the currently used same type PCB due to the lower price of the CPU.

The company plans to sell its own brand and on the OEM basis.

*** ASIC Co., Ltd.**

5-7, Nishi-Kamishima-cho, Fukuyama
City, Hiroshima Pref. 720-0092
Tel: +81-849-51-7300
Fax: +81-849-51-6030

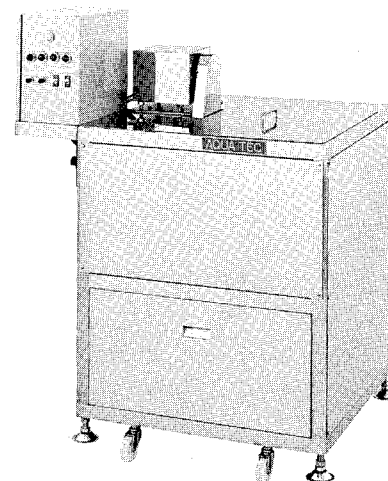


Structure of PIC mounted PCB

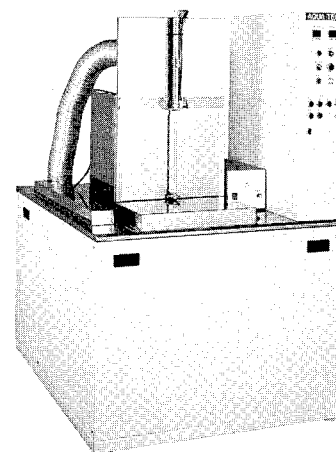
98-05-002-04

Ultrasonic Wave Automatic Washing Machine

Aqua Tec Co., Ltd. has developed an ultrasonic wave automatic washing machine Shady that is available in a 5S Model and a 5M Model, and which incorporates a washing fluid purification system. This new washing machine features an excellent dewatering function, so the generation of stains on the workpieces is prevented, and displays an excellent anti-corrosion resistance. This washing system incorporates a purification system and, instead of emulsifying oils and fats, removes these components into a separate adjoining tank to remove the particles with a filtration system. In addition, it uses a non-rinse type

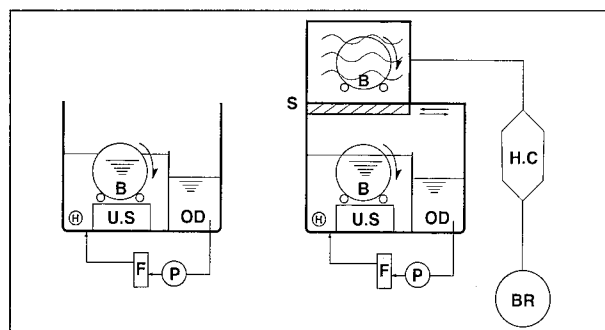


Shady 5



Shady 7

NEW TECHNOLOGY & PRODUCTS



P: Pump
F: Filter
U.S: Ultrasonic wave vibrator
B: Barrel type washing cage
H: Heater
OD: Oil removal tank
BR: Blower
HC: Heat exchanger heater
S: Automatic shutter

Shady Model	5S Shady Model	5M Shady Model	7S Shady Model	7M Ultrasonic
Wave System	200V 600W	200V 1200W	200V 600W	200V 1200W
Cage Size	300×200×150 ^H 200φ 300 ^L	400×300×200 ^H 300φ 400 ^L	300×200×150 ^H 200φ 300 ^L	400×300×200 ^H 200φ 400 ^L
Heater Capacity	200V 3KW	200V 6KW	200V 4KW	200V 6KW
Purification System	Oil/water separation filter	Oil/water separation filter	Oil/water separation filter	Oil/water separation filter
Circulating Pump	200V 100W	200V 200W	200V 100W	200V 200W
Automatic Dryer			200V 6.4KW 150 C 10m ³ /min	200V 9.4KW 150 C 20m ³ /min

Specifications of washing machine

detergent, which eliminates the need for the rinsing process as well as the need for waste water treatment.

Washing is performed by oscillating the workpiece vertically inside the ultrasonic wave environment or by revolving a barrel mechanism. The chlorine in the washing water is removed beforehand with an ion exchange resin, while an in-built heater heats the fluid temperature to about 80 °C, so high-temperature washing is accomplished and a special type of detergent is used that dewater and dries the workpiece while hot to permit washing without generating stains.

The cage for placing the workpiece of the 5S Model is 300 × 200 × 150 mm, and of the 5M Model 400 × 300 × 200 mm. The 5S Model ultrasonic wave washing machine with an output of 600 W is sold at a domestic price of ¥1,480,000 and the 5M Model washing machine with an output of 1,200 W at a price of ¥1,870,000. A model is also available that performs all operations from washing to drying automatically.

* **Aqua Tec Co., Ltd.**

1-14-22, Saiwai-cho, Shiki City, Saitama

Pref. 353-0005

Tel: +81-48-472-9260

Fax: +81-48-472-9525

98-05-002-05

Molecular Beam Epitaxial System with Atomic Layer Monitor

ULVAC Japan Ltd. and Shimadzu Corp. have jointly developed a molecular beam epitaxial (MBE) system "MBC-1000-

TALIS" with an atomic layer monitor which can form gallium arsenide monocrystalline films on the wafers of high-speed devices or red light semiconductor laser devices, and form gallium nitride monocrystalline films on the wafers of blue light laser device.

The red light semiconductor laser device is widely used as the light source for reading out information relating to compact disks (CDs) and digital video disks (DVDs), and the blue light laser is presently under research as a light source for reading out information relating to next-generation version large-capacity DVDs.

The system mounts an atomic layer monitor based on the coaxial type direct bombardment ion scatter spectroscopic technique, and enables analysis of the specific type of element and the positions of surface atomic layers without exposing the specimens to the atmosphere. The type of element and the atomic layer position on the outermost surface can be identified by the atomic layer monitor (using the RHEED crystal analysis technique). The system is marketed at a domestic price of ¥65,000,000-80,000,000 depending on its specifications.

* **ULVAC Japan Ltd.**

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Kanagawa Pref. 253-8453

Tel: +81-467-83-1151

Fax: +81-467-58-5773

Machinery & Mechatronics

98-05-003-01

Compact Commercial Rice Polisher

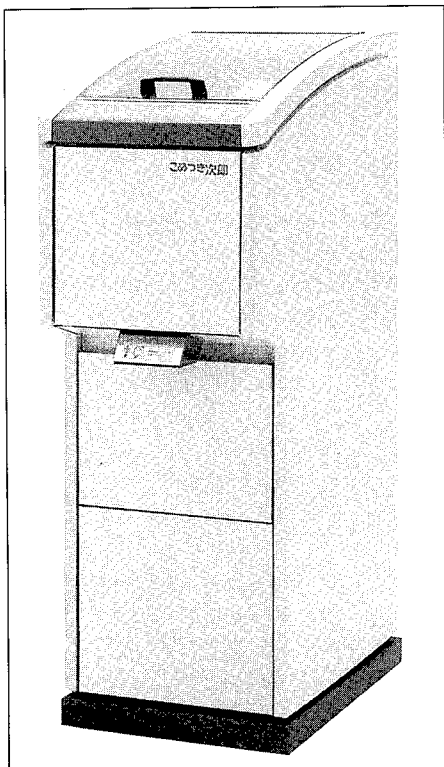
Yanagisawa Seiki Mfg. Co., Ltd. has developed a compact commercial rice polishing machine Kome-Tsuki Jiro (Rice Polishing Jiro) that is ideal for installing in supermarkets and convenience stores.

This rice polishing machine is worked with a 2 HP motor and polishes 2 kg of rice in 1.5-2 min. Polishing is started simply by depressing the start pushbutton, and the polishing degree can be set by fingertip setting to half-polishing or to full polishing to meet client needs. The bran box of the conventional type of rice polishing machine is assembled together with the machine, so there is no bran scattering and the working environment is constantly maintained in a clean and sanitary state.

When the bran tank becomes full, the machine is stopped automatically and a

buzzer sounded to permit the machine to be worked safely. In addition, a low-temperature polishing function is incorporated that improves the polishing efficiency, collects the bran effectively and increases the rice flavor. The polishing machine has been accredited by the Japan Electrical Safety & Environment Technology Laboratories (JET).

The machine is (W)360 × (D)600 × (H)1,000 mm, weighs 90 kg, the hopper capacity is 10 kg, and the bran tank maximum capacity 4.5 kg. The domestic Food Control Act has been revised in conformance with deregulation moves, and the sale of rice has been changed from the permit system to the notification system to enable anyone to sell rice. The company applied its expertise accumulated through its years of manufacturing household rice polishing machines as well as its technology acquired through its manufacture of automotive



Compact commercial rice polisher

parts, and succeeded in developing a commercial rice polishing machine enabling rice polishing with ease in supermarkets and convenience stores.

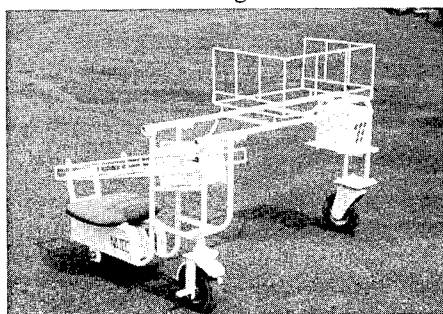
*** Yanagisawa Seiki Mfg. Co., Ltd.**

7001, Sakaki, Oaza, Sakaki-machi,
Hanishina-gun, Nagano Pref. 389-0688
Tel: +81-268-82-2850
Fax: +81-268-82-2857

98-05-003-02

Motor-Driven Strawberry Harvesting Work Trolley

Kyushu Electric Power Co., Inc. and Kiden Co., Ltd. have jointly developed an electric motor-driven strawberry harvesting work trolley that enables strawberries to be harvested with the worker sitting on the trolley. The trolley is electrically driven and therefore does not generate much noise



Motor-driven strawberry harvesting work trolley

or exhaust gas. Forward and reverse motions are selected by working a switch by a change-over switch, so the trolley is workable with ease even by female and elderly workers. In addition, the body can be disassembled into the drive unit and battery unit for easy portability. Compared with hand-picking, the work efficiency is improved considerably.

The new work trolley working width can be adjusted flexibly depending on the shape of the strawberry field furrows, battery charging is accomplished with household 100-W power, and work can be continued for four hours with a single charging operation. The trolley, together with a battery, is marketed at a domestic price of ¥400,000.

Kyushu is a leading strawberry production region that accounts for about one-third of the country's entire strawberry production. Since strawberry picking and sapling planting are both performed by workers bending over for long periods of time, improvement of the farming work environment had been needed.

*** Kiden Co., Ltd.**

2-7-2, Takasago, Chuo-ku, Fukuoka City,
Fukuoka Pref. 810-0011
Tel: +81-92-525-2287
Fax: +81-92-525-7393

98-05-003-03

Wear-Resistant Finishing Abrasive Stick Made of Alumina Fiber

XEBEC TECHNOLOGY Co., Ltd. has developed a wear-resistant polishing finishing abrasive stick made of alumina fiber that is an aerospace material.

Conventional types of finishing abrasive sticks are produced by solidifying abrasive grains with a bonding agent, so were fractured, cracked or chipped. The newly developed finishing abrasive stick is made of a fiber, so the finishing abrasive stick consists of a continuous composition of high density, and features an excellent machining accuracy, high grinding efficiency and great resistance to damage. In addition, the finishing abrasive stick has a self-sharpening action and is not clogged.

The finishing abrasive stick marketed this time is a stick shaped type (length 10 cm, width 4 mm and thickness 1 mm) that is sold at a domestic price of ¥1,900. A bar (round) type is also available (diameter 3 mm and length 5 cm) that is sold for ¥1,950.

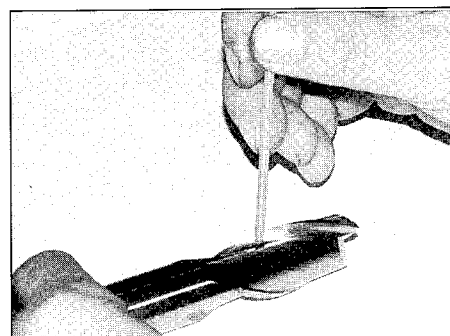
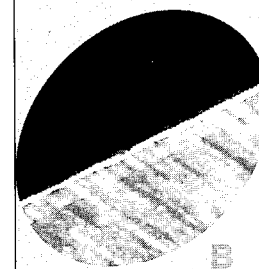


Photo shows the endmill blade tip magnified by 250 times with an optical microscope



State of the blade tip after grinding (burrs present)



State of the blade tip stroked once with a Meister finishing type round bar (red)

When removing burrs from the blades of endmills with the bar type finishing abrasive stick, a diamond tool was employed to remove the burrs from the blade tips, which caused the problem of damage to the blade tips. Using the finishing abrasive sticks developed this time enables burrs to be removed with great ease as shown in the accompanying photos, without damaging the blade tips. The new finishing abrasive sticks feature an enormous strength and can be used by fitting them onto ultrasonic wave tools which are used in the machining of steel files, so that the working speed is improved substantially.

*** XEBEC TECHNOLOGY Co., Ltd.**

3-2-2, Kudan-Minami, Chiyoda-ku, Tokyo
102-0074
Tel: +81-3-3239-3481
Fax: +81-3-5211-8964

98-05-003-04

Reliable 7-Axes Hydraulic Press Brake Based on Personal Computer CNC Control

Aizawa Tekkoshu Ltd. has developed a highly reliable 7-axes hydraulic press brake that is based for the first time in Japan on personal computer CNC (computer numerical control). The company had been engaged primarily in the manufacture of hydraulic press brakes based on three-axes CNC control, but in response to user needs, commercialized Aizawa Press brake with Linear scale positioning system type hydraulic press brake that is available in models from three-axes control to 7-axes control depending on the specific purpose.

With this hydraulic CNC press brake, when the target workpiece comes into con-

tact between upper and lower dies, the difference in the plate thickness with respect to the reference plate is measured automatically. For this, the plate thickness must be over 1.6 mm and the standard V-opening width of die over 6 times the plate thickness. The allowable range of thickness fluctuation is 1%-10%, and the depth computed by automatic arithmetic control in conformance with the plate thickness so as to maintain the bending angle at a minimum deviation.

In addition, this CNC press brake ram incorporates a center flexure compensator to eliminate any workplate center flexure caused by deflection of ram and table as well as to simultaneously minimize camber, to enable precision sheetworking. In addition, due to the personal computer CNC control mounting a liquid crystal touch panel, bending data can be input from the office by using a DOS-V format versatile type personal computer.

The control system is available in an assortment of seven types depending on a combination of the ram vertical motions as well as the back gauge forward, reverse and rise motions, and the machine capacity is available in eight stages from 55 t to 300 t. The press brake is sold at a domestic price from ¥8,500,000. The company plans to market these press brakes primarily for use by the precision sheetworking industry for

manufacturing electronic equipment and steel furniture.

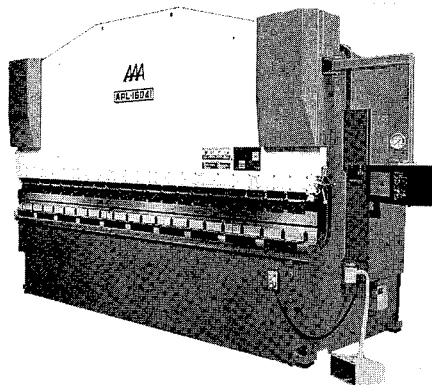
* Aizawa Tekkoshu Ltd.

1-16-10, Edo, Kawaguchi City, Saitama

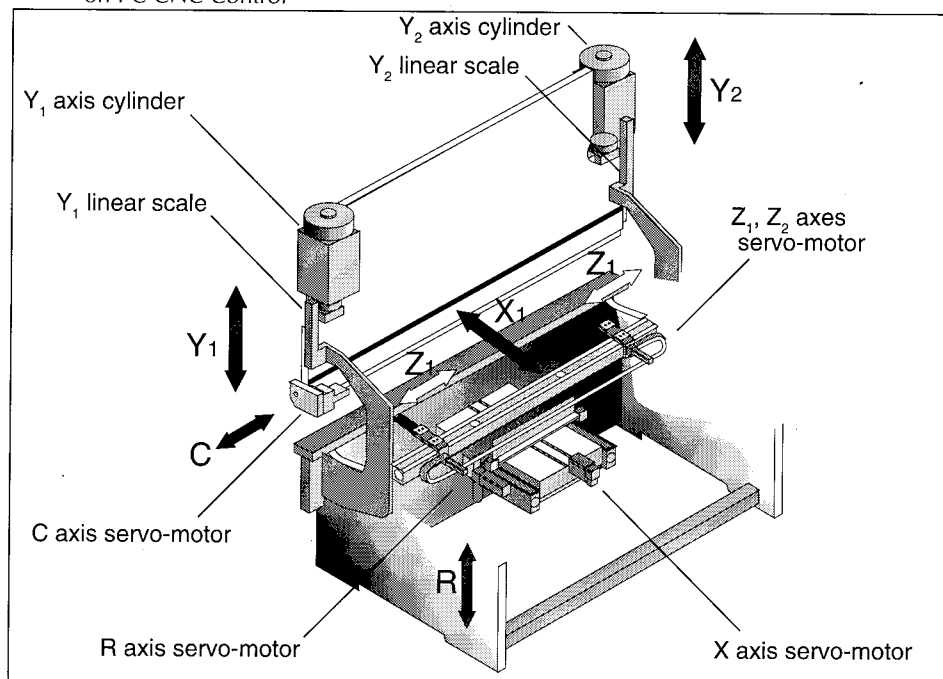
Pref. 334-0074

Tel: +81-48-281-3740

Fax: +81-48-282-4787



Reliable 7-axes hydraulic press brake based on PC CNC Control



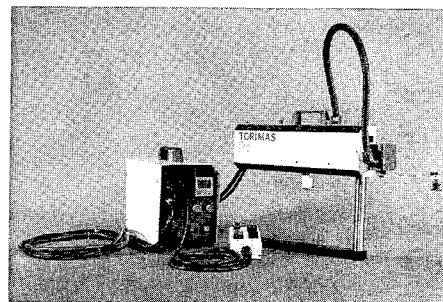
APLIC 3702

98-05-003-05

Simplified Takeout System for Vertical Type Forming Machines

Kasai Seisakusho Co., Ltd. has developed a simplified takeout system TORIMAS (Takeouter) that is applicable to virtually all types of vertical forming machines such as presses, injection molding machines and polishing machines.

The system is compact and lightweight, and the takeout position and takeout preparations can be accomplished with ease. It has a portable weight of 300-500 g, and is compatible with either single-loading or roller-feeding processes. The adsorption system uses either vacuum, magnet, mechanical chucking or balloon chucking. An interlocking circuit is incorporated to cope with takeout mistakes. The drive unit weighs about 7 kg, the working speed is as high as 650 mm/s, and the stroke 100-500 mm.



TORIMAS

A single-function version system features a power consumption of only 10 W and is ideal for use by economy-oriented factories. By improving the takeout efficiency in existing work processes, the work efficiency is expected to be improved by about 20%. The takeout system domestic selling price will differ with the specifications, but is about ¥498,000, about 20% cheaper than that of its conventional counterparts.

* Kasai Seisakusho Co., Ltd.

1137, Oshitate, Inagi City, Tokyo 206-0811

Tel: +81-42-377-6739

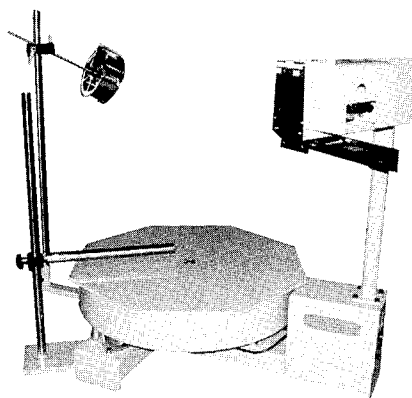
Fax: +81-42-377-6739

98-05-003-06

Octagon-type Turntable for Easy Location of Material Center

Yutani Co., Ltd. has developed an octagon type turntable allowing easier location of the center of materials using a pinch roller and by forming a loop that usually sits on a square table, so there is no negative impact on the feeder.

The rotation control of previous turntables was by upright dancing bar, etc., but the resultant vibration had a negative impact on the feeding device. In contrast, the octagon type turntable with attached with pinch rollers and forming a safe loop has



Octagon type turntable

no negative impact, so is ideal for materials that cannot resist the strong downward pressure of feed rollers.

Until now, all turntables were round in shape, and as material normally sits on square pallets, centering was difficult. Centering the material on the octagon table is much easier by visual inspection. This turntable is marketed at ¥890,000.

* **Yutani Co., Ltd.**

5-1-7, Nagayoshi-Deto, Hirano-ku, Osaka

547-0011

Tel. +81-6-709-8505

Fax. +81-6-709-8588

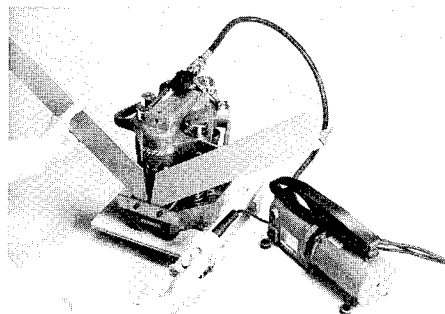
Major specification of octagon-type turntable

Table Main Specifications		Option
Coil weight	Max. 1000 kg	Leveler
Coil width	Max. 50 mm	Unravel prevention roller
Coiling height	600 mm (above the table)	Centering drum
Pallet dimensions	900 mm square	Coil end detector
Speed	Max. 20 m/min	Mark detector
Rotational diameter	Max. 1,280 mm	Casters

98-05-003-07

Angle Machine with Large Machining Capability

Asada Corp. has developed an Angle Machine 75 that features the largest machining capability in its class among the company's series of angle machines for working with portable angle materials (equal-angle steels). The machine can work with angle materials with the maximum dimensions of 75 × 75 × 6 mm, and is ideal for producing racks and frames when engaging in piping, duct installation and electrical work.



Angle machine 75

The machine is usable for cutting angle corners from 45 to 90 degrees, also for square cutting and for 90 degrees V-cutting, also usable for bending subsequent to cutting. In addition, since the V-notching and bending units are incorporated in a unit assembly with the machine, up to five different angle working tasks are possible without having to change the machining dies. As an optional specification, hole opening with a puncher is possible. The machine is a separate type consisting of the body of 7.5 kg and a hydraulic pump, and two hydraulic cylinders are provided for use in cutting and bending tasks, so work is advanced with ease. The machine can also be conveyed to workplaces with ease. It is sold at a domestic price of ¥698,000.

* **Asada Corporation**

3-60, Kamiida Nishi-machi, Kita-ku,

Nagoya City, Aichi Pref. 462-0809

Tel: +81-52-914-1206

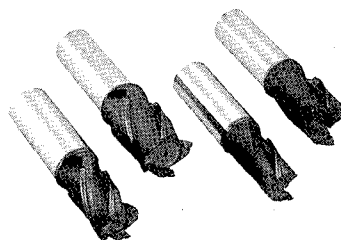
Fax: +81-52-914-2011

98-05-003-08

Carbide Brazed End Mills with (Al, Ti)N Coating

Shinko Kobelco Tool Co., Ltd. has developed a series of cutting tools Miracle Jumbo End Mills for high speed cutting with more than five times longer tool life than conventional carbide brazed end mills.

VJ-2MS (two flute type) and VJ-4MS (four flute type) are used in combination with the machine tools of machining centers for machining automobile parts and metal dies. Both these cutting tools are available in seven sizes with diameter from 20mm to 50mm, and the size is selectable freely depending on the sizes and shapes of the parts to be machined.



Carbide brazed end mills with (Al, Ti)N coating

The cutting speed of the VJ-2MS is 35-100m/min, and since these end mills are coated with (Al, Ti)N coating featuring longer tool life for excellent wear resistance and heat resistance. These end mills are usable for machining with hard materials (45-55HRC) for which conventional types has been unusable.

The VJ-2MS model is marketed at a domestic price of ¥38,600-124,000, and the VJ-4MS model at price of ¥43,000-136,000, depending on the specifications.

* **Shinko Kobelco Tool Co., Ltd.**

Planning & Administration Section

Sale & Marketing Dept.

Kobelco Bldg., 3-2, Toyo, 2-Chome, Koto-

ku, Tokyo, 135-8381

Tel: +81-3-5634-5440

Fax: +81-3-5634-8413

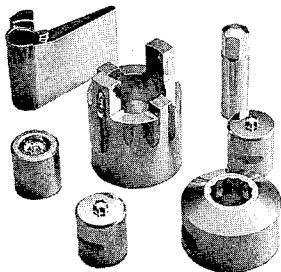
98-05-003-09

Metal Die Automatic Slickenside Finishing System

Yamashita Works Co., Ltd. has developed a system for the slickenside machining of metal die surfaces inside a treatment system by applying unique technology to perform the task that previously was accomplished almost entirely by manual labor.

With this new system, the metal die placed inside the system container is magnetized, and the abrasive grains adhered on the die surface vibrated to polish the die surface. Slickenside polishing is accomplished by vibrating and moving the abrasive grains, so there is no need for setting jigs or concern about the die shape. With a die of complicated shape, for example, 2-3 hours of labor had been necessary for finishing previously, but this is now accomplished by the new system with ease in 2-3 min. A technique using a machine had been available previously for the slickenside polishing of dies of simple shapes, but the new system excels in that it does not unnecessarily shave off the edge and corner parts of these dies.

The polishing work is performed in a closed container, so problems such as the generation of dust and excessive noise associated with conventional methods are eliminated, and work is accomplished in a clean environment. The conventional type of abrasive material was costly, but the new system enables recycling of these abrasive grains to enable cost reduction. In addition, the degree of finishing can be controlled and standardized, so the new system features excellent reproducibility and does not require highly skilled workers.



Metal die automatic slickenside finishing system

Slickenside finishing is a preliminary process that is indispensable prior to coating to increase the strengths of metal dies, so the newly developed system is anticipated to be in wide demand. At present, the system has been used successfully for the slickenside finishing of compact metal products, and the company plans to produce the system in a larger configuration to enable application to the finishing of larger metal dies.

*** Yamashita Works Co., Ltd.**

2-13-22, Nishimachi, Kukuchi, Amagasaki City, Osaka 661-0978
Tel: +81-6-426-3361
Fax: +81-6-426-3882

Information & Communications

98-04-004-01

CD-ROM Storing 3-Dimensional Computer Graphics Image Data

nKer Inc. has marketed the readout memory 3D Pocket that uses a CD-ROM (compact disk) to store various three-dimensional computer graphics (CG) image data.

This 3D modeling data contains all principal modelling applications, and stores five types of data relating to the modeling of furniture such as tables and chairs, tools such as vices and wrenches, sundry goods such as cups and dishes, studios containing target storage materials and others containing gears and fins. It also incorporates a rich assortment of data including modeling texture data (only for shading) for patterning using modeling data, form of bevel data consisting of extrusion modelers usable in lathing, and primitive data containing shapes which are basic but difficult to form.

The stored models are all original designs and quite different from commonplace model collections, and provide complete satisfaction for building designers. The original browser has been selected for maximum visual convenience and therefore can be used and preserved with ease,

Main specifications

Data format	STRATA shape, Shade shape data, Ray Dream Designer, Detaller, Infini-D, 3DMF, DXF	
Number of data	Modeling data:	292 x 7 forms
	Modeling texture:	100 (Shade)
	Primitive data:	140 x 3 forms
	Form of bevel:	120 (STRATA)
	Others:	598 data
Compatible computers	Macintosh	

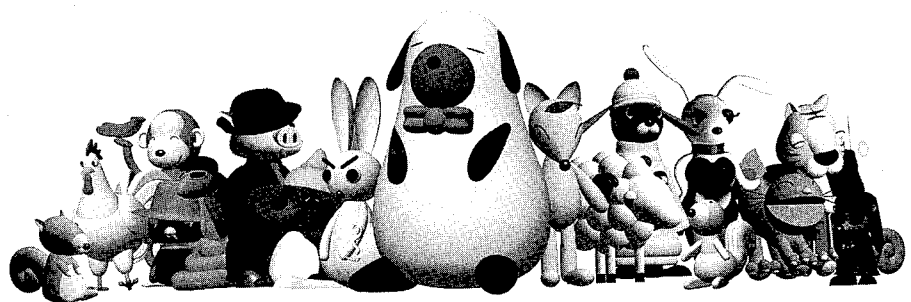
incorporates advanced movies which explain the stored data in an easily understandable method, all features of excellent 3D applications software.

The CD-ROM will be marketed at a domestic price of ¥9,800, which represents an excellent cost-performance among existing 3D modeling data collections, but the first 5,000 units are presently being offered at a sales campaign price of ¥6,800. The device is ideal for use by beginners of 3D computer graphics and those who desire to minimize the time required for modeling data preparation in their work. The device modeling data are usable freely by anyone, and usable in games, home pages, pamphlets and multimedia titles. The company permits purchasers to use these data in designs, but the copyright is not for sale.

The company plans to successively market a series of its second-version 3D Pocket as well as other versions of the present device.

*** nKer Inc.**

2-3-3-911, Terauchi, Toyonaka City Osaka
560-0872
Tel: +81-6-867-2168
Fax: +81-6-862-4849



CG image data

98-05-004-02

Miniature Optical Variable Attenuator

Santec Corp. has developed a miniature optical variable attenuator with a compact and lightweight construction and can be use in a variety of optical communications and measurement systems, but is particularly suitable for wavelength division multiplexing applications.

This attenuator utilizes a neutral density (ND) filter with excellent temperature stability and low wavelength dependence. Metal bonding of optical components using a YAG laser is employed to ensure long term, high reliability.

This attenuator is applicable to optical communications systems, optical amplifier output control, LD light source output control, measurement and assessment systems, and R&D for optical communications fields.

Specification of miniature optical attenuator

Temp. dependence: ± 0.05 dB at 0 - 65°C

Shock and vibration resistant: ± 0.01 dB

Wavelength dependence (1545 - 1565 nm)

± 0.3 dB p-p (at 10 dB attenuation)

± 0.4 dB p-p (at 20 dB attenuation)

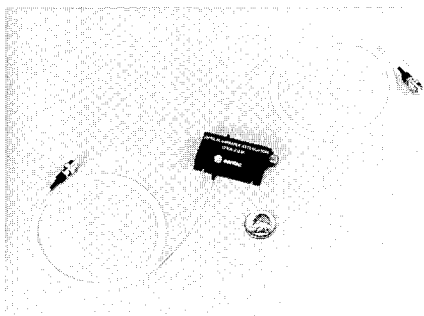
± 0.5 dB p-p (at 30 dB attenuation)

Low insertion noise: <1.5 dB

Components laser welded for reliability:

<0.1 dB PDL over entire range

Compact size (8 mm height) can be built into systems



Miniature optical variable attenuator

* Santec Corp.

Micom Valley Tohkada, Kamisue, Komaki,

Aichi Pref. 485-0822

Tel. +81-568-79-1959

Fax. +81-568-79-3538

98-05-004-03

Gesture Recognition and Voice Recognition Software Driven Simultaneously with Notebook Personal Computer

Real World Computing Partnership (RWP) Tsukuba Research Center has developed a software that enables the operator to use gestures and voice for conversation with a virtual individual on a notebook type personal computer available on the market.

With the newly developed software, the number of gestures and voice (words) which are usable are as yet limited, but the gestures and words to be recognized can be registered in the software on the spot. This is the world's first time that the gestures and words used in human life are handled as multimedia data.

With existing software, gesture recognition and voice recognition have to be performed on a workstation or a personal computer using a special-purpose board. The technology (software) developed this time enables two software, one for gesture recognition and another for voice recognition, to be driven simultaneously in real time with a single notebook type personal computer available on the market.

Essential to the development of these software are a technique to schedule the computation to allow various types of necessary operations to be accomplished with a single CPU, and a gesture and voice recognition technique (called spotting technique) that minimizes the gesture and voice computing volume to enable real-time processing even with a single CPU. In addition, when using the newly developed soft-

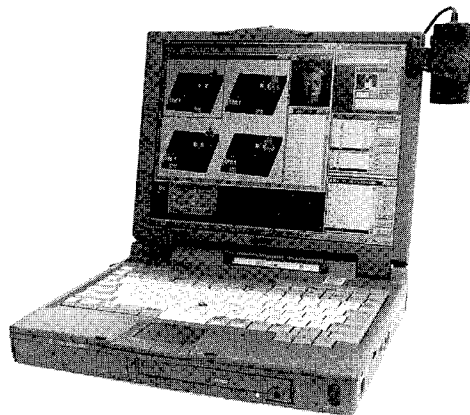


Photo 1. Gesture and voice manipulation type notebook personal computer (MMPC)

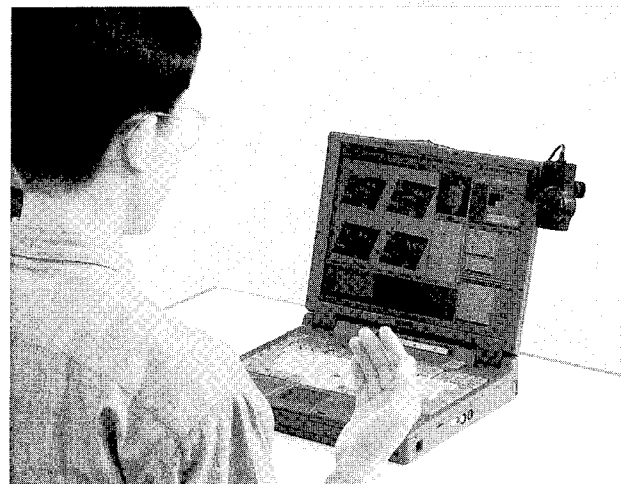


Photo 2. Example of natural conversation with personal computer

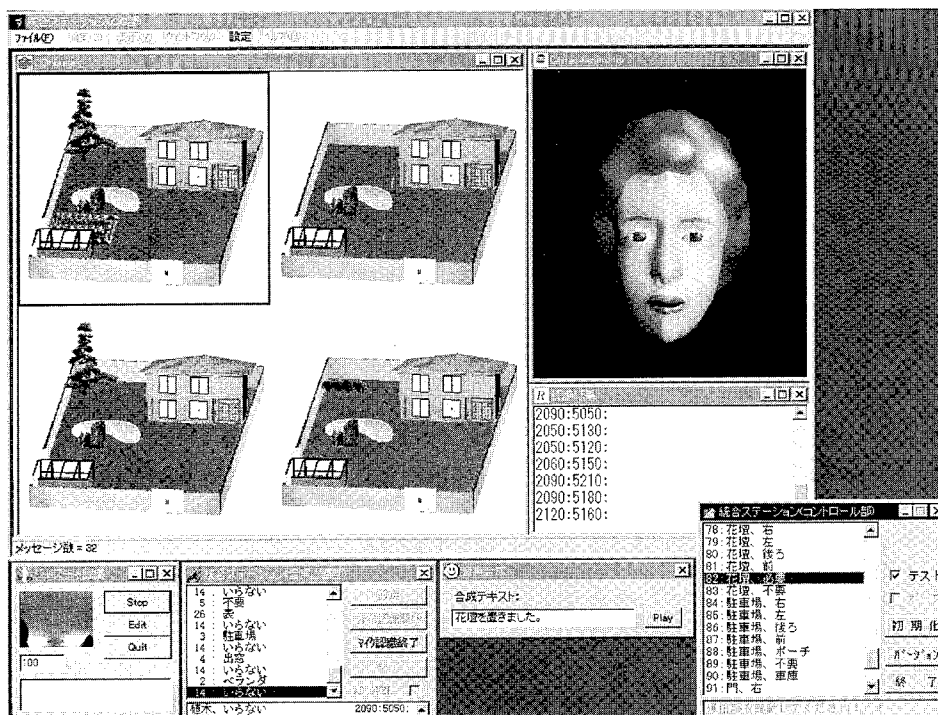


Photo 3. Personal computer screen in conversation

ware, a notebook type personal computer will retain a surplus computing capability even when both gesture recognition and voice recognition are executed simultaneously in real time. This surplus computing capacity enables a single notebook type personal computer to simultaneously perform various types of other tasks.

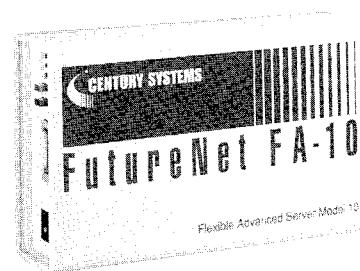
* **Real World Computing Partnership(RWP)**
Tsukuba Research Center
 Tsukuba-Mitsui Bldg.13F, 1-6-1, Takezono,
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98-05-004-04

Compact, Inexpensive Access Server/Remote Router

Century Systems Inc. has developed the FutureNet FA-10; an ultra-compact Ethernet/RS-232C converter. It can be used as an ACCESS SERVER plus a REMOTE ROUTER for Small Offices and Home Offices (SOHO). The size of the board is 54mm by 85mm. The size of the case is 100mm long, 62mm wide and 28mm high.

The Ethernet/RS-232C converter enables POS systems, FA equipment and digi-



FutureNet FA-10

tal cameras with an RS-232C port to be connected to an Ethernet or Internet system. Up until now a personal computer was required for the conversion, but the FA-10 can control multiple systems via the Ethernet or Internet.

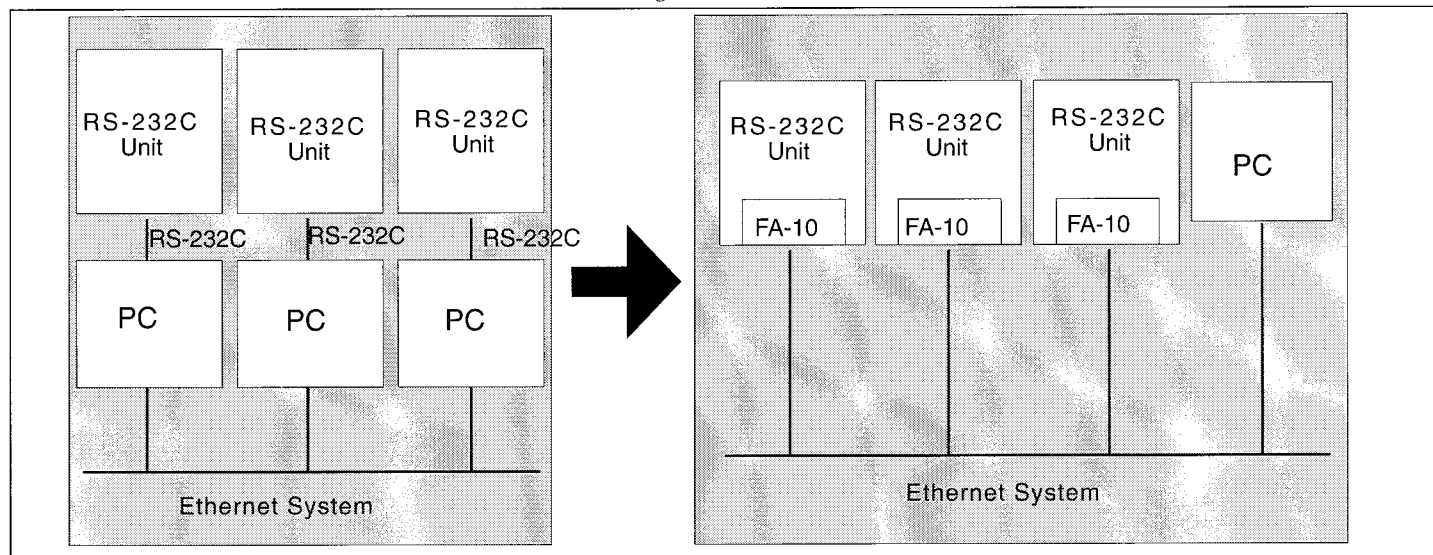
The FA-10 can also access a company's server or an internet system from a business or home computer. Using the dial-out function, multiple corporate users can simultaneously access the Internet System without having to provide a modem for each individual personal computer.

Century plans to market systems that link an employee on a business trips to the corporate network. The company also will supply the board only for Original Equipment Manufacturers (OEM) who wish to connect their device to a network.

* **Century Systems Inc.**

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Diagram of FutureNet FA-10



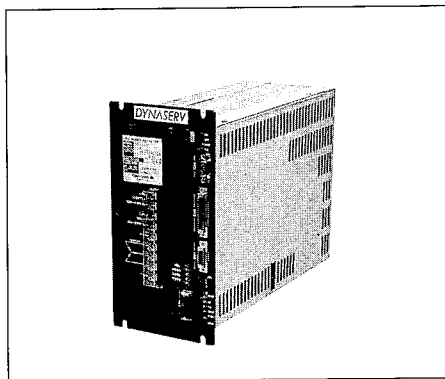
Process & Production Engineering

98-05-005-01

M-Type Driver

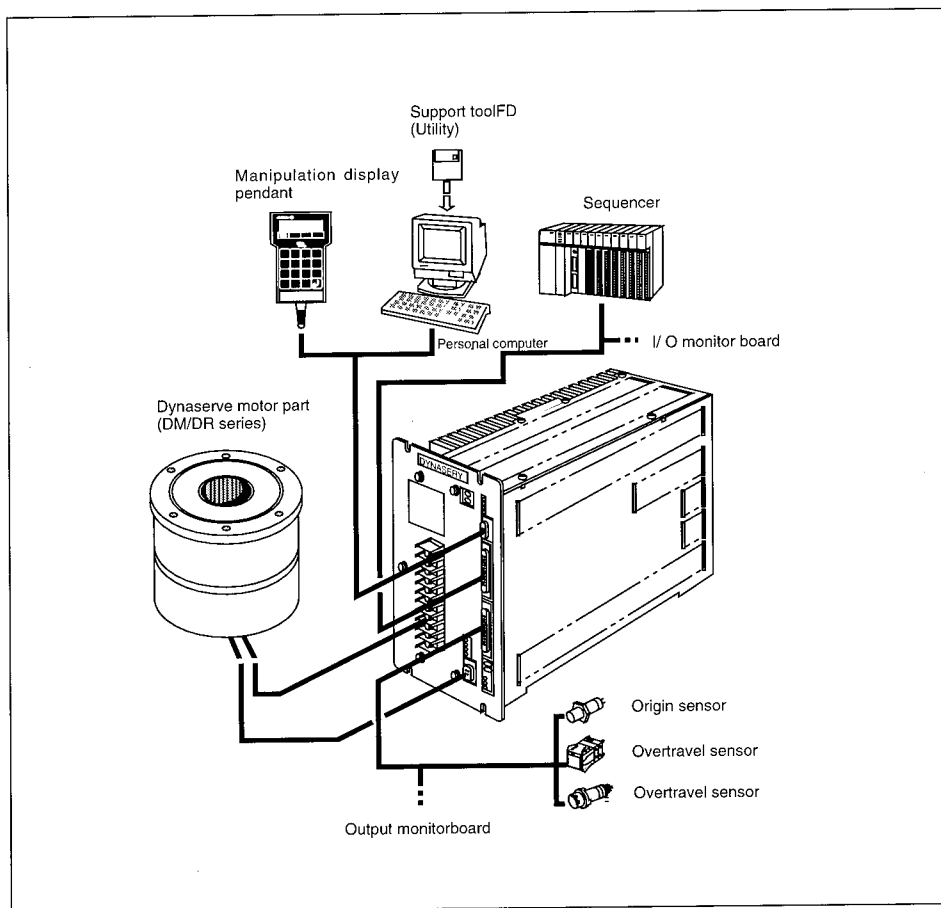
Yokogawa Precision Corp. has started marketing a drive system M-Type Driver to control the direct drive (DD) motors of factory automation (FA) systems which incorporates a controller.

The M-Type Driver is a new type of built-in controller for direct drives and dynaserve drivers with the communications function reinforced by the addition of a controlling function. The driver remodeling now permits easier manipulation and adjustment, so that indexing, program operation and point instructions can be performed with greater ease, and all adjustments are accomplished digitally. In addition, the driver displays an automatic tuning function, and a per-



M-Type Driver

sonal computer utility is also available that is compatible with Windows '95. Smooth operation can be achieved by the cam curve function which features the user cam function.



M-Type Driver

JETRO, May 1998

Incorporating a controller, the M-Type Driver is slightly larger and more expensive, but eliminates the need for a separate controller. The company is marketing the new driver primarily for use in semiconductor and liquid crystal manufacturing systems and by manufacturers of various types of FA equipment. A set consisting of the driver and a motor is marketed at a domestic price of ¥330,000-840,000 depending on its specifications.

* **Yokogawa Precision Corporation**

MD Sales Office

1-19-18, Nakamachi, Musashino City,

Tokyo 180-0006

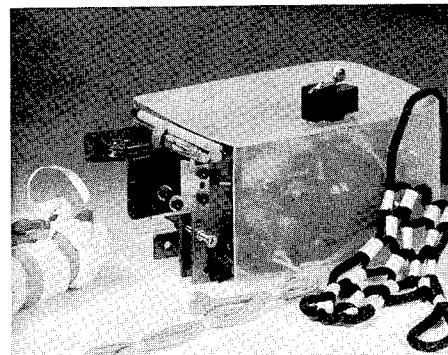
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98-05-005-02

Portable Automatic Packing Machine

Tsuruta Machine Service Co., Ltd. has developed a prototype portable automatic packing machine that is also usable as a robot hand. This machine was developed based on manual movement. In contrast with conventional types of packing machines using various types of mechanical parts interlinked with electric circuits, the new system uses only a single automobile window wiper type motor powered with 12 V that performs system forward/reverse switching with a newly developed locking clutch. Also, the worktable has been made smaller to pack a small packages with widths as fine as 5 mm, which had been difficult previously.



Portable automatic packing machine

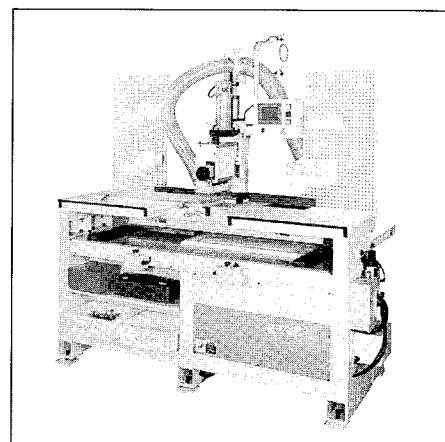
With the newly developed packing mechanism and pasting structure, a pressure press of 100 kg/cm² acts upward vertically with respect to the pasting table when engaging in pasting operations. When cutting the tape, a force of 200 kg/cm² acts to clamp the table downwards even if the package exerted a force of 100

98-05-005-03

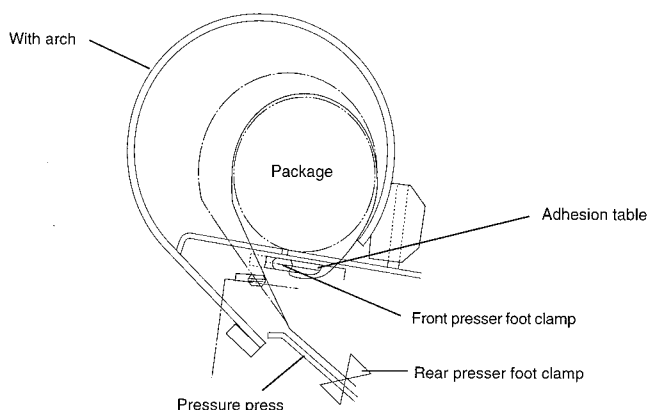
Machine for Semi-Automatic Fitting of Door Handle and Hinge

Yasaka Co., Ltd. has marketed a machine called Ude-Jiman (Crackerjack) that enables the assembling and production of door handles and hinges semi-automatically by a single worker. It is marketed at a domestic price of ¥5,500,000.

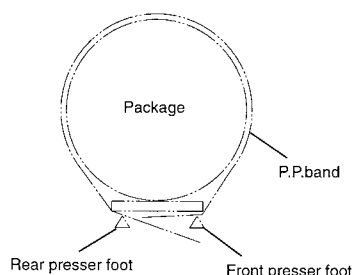
Ude-Jiman, Model HS-11, comprises a compact numerically controlled (NC) machine that mounts an automatic and a manual boring machine in its upper and lower stages, and integrates the task of hinge insertion. This hybrid machine enables a single worker to perform two kinds of tasks simultaneously, drilling and inserting the hinge automatically on the underside of a worktable and drilling of handle on the upper side of the worktable. The machine is available in the hinge insertion type and the hinge screw-tightening type.



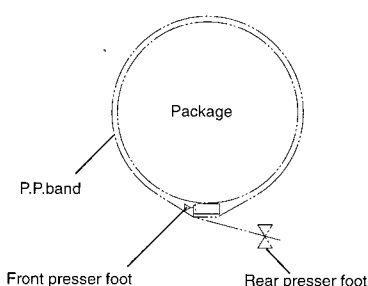
Machine for semi-automatic fitting of door handle and hinge



Developed packing machine



Conventional packing device



New packing device

Schematic diagram

kg/cm to raise the pasting table. Therefore, the force of 100 kg/cm² acting to raise the pasting table will consist of a positive force of 100 kg/cm² plus 100 kg/cm² minus 200 kg/cm², or the force will be counteracted and no force will be acting whatsoever, which enabled the pasting table to be designed compact.

The new automatic packing system introduces a cam structure that is entirely different from those of conventional packing systems, the fixed table (slide table) is moved forward and back, and the cam of the fore pressing clamp and the cam for heater pasting have been accommodated on separate shafts, so that paste melting with heater and compression cooling can now be accomplished most efficiently and effectively.

Three methods are adopted to adjust the system clamping torque—a spring system (used in portable automatic packing ma-

chines), a ratchet limiter system (provides an intense clamping force) and a magnet system (incorporates a balance using a magnet). As a result, it is now possible to accomplish commodity packing and binding which had been impossible previously. The new system is usable as a portable packing machine, but also as a fish net repairing machine, donut-shaped (hose, rope, wire) commodity binding machine, cross-shaped reinforcing steel packing machine, combined internal binding machine, wiring binding machine (inside control panels and others), book binding machines (in place of existing stapler and wire type binding machines) and spinning machine.

* **Tsuruta Machine Service Co., Ltd.**

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* **Yasaka Co., Ltd.**

Public Relations Dept.
147, Kanaori-cho, Hamamatsu City,
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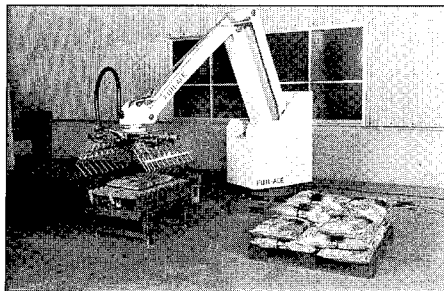
98-05-005-04

World's Fastest Palletizing Robot

Fuji Yusoki Kogyo Co., Ltd. has developed the world's fastest palletizer robot with a capacity of 1,600 cycles/h. The new line of Fuji Ace robots has the largest capacity achieved, and five models with different handling capacities, can meet customer's various needs.

The New Fuji Ace series palletizing robots feature both larger capacity and lighter weight compared to their previous models. The number of parts has also been reduced by around two-thirds, thus the robot weights only one ton, a substantial reduction from the usual weight of 1.7-2 tons. This lighter weight translates into lower installation costs and both energy and expenses savings as the electrical consumption has also been reduced by 40%.

Moreover, the working range is also up 33% compared to the company's present counterparts (longitudinal distance 1,500 mm, vertical distance 2,300 mm) giving much more freedom.



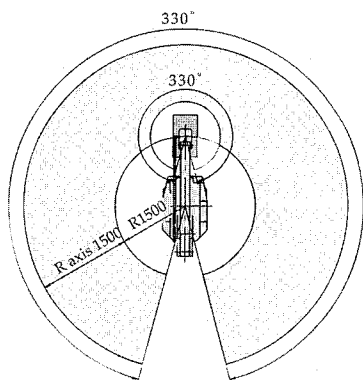
World's fastest palletizer robot

All tasks can easily be performed by the user friendly touch screen, including maintenance and teaching.

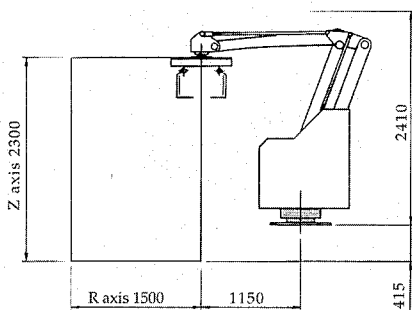
All the teaching can be prepared through the 3-way configuration (teaching playback system, teaching support system, teachingless system.) These efficient ways to do teaching save time and therefore money.

* **Fuji Yusoki Kogyo Co., Ltd.**

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Movement area



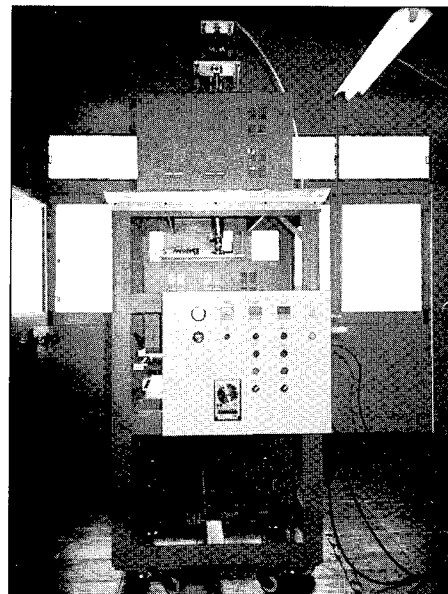
Robot dimensions

98-05-005-05

System for Automatically Heating and Feeding Fluid Materials

Tsunatori Electric Mfg. Co., Ltd. has developed a system S-21S for automatically heating and feeding fluid materials. The system is usable for feeding all kinds of fluid industrial materials including chemical products such as solders and paraffin, as well as fluid food processing materials. It is designed for simple manipulation, convenient transportation, can be incorporated with ease into all kinds of production lines, and the output volume can also be selected flexibly.

The feed system uses a cartridge type heater that heats and melts fluid materials up to a maximum of 350°C and feeds a minimum of 100 g of the material accurately at a prescribed rate. The pitch speed can also be set freely. When working with solders, for example, the system is equipped with two tanks, one for melting the solder and the other for heating the solder to the prescribed temperature and feeding the material effectively. These tanks are made of stainless steel and the capacities can be selected freely.



System S-21S

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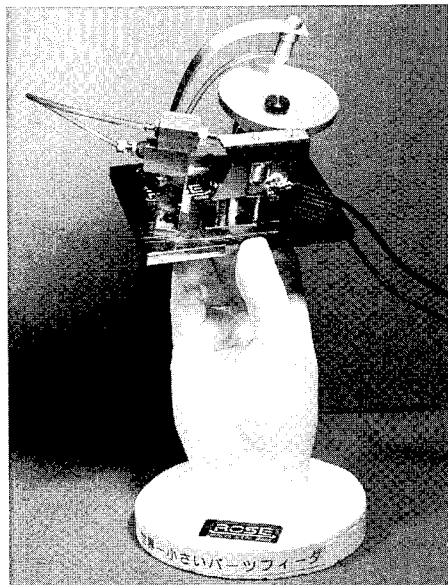
98-05-005-06

Micro Parts Feeder

Robotics Systems Engineering Corp. has developed a parts feeder that can neatly arrange ultrathin microparts with diameters of 2.5 mm and thicknesses of 0.05 mm instantaneously. Especially intended for the distribution of little parts (microelectric parts and watch parts.) The feeder is ideal for use in production lines handling precision components such as timepieces, electronic chips, capacitors and inductors.

This is an vibration parts feeder incorporating a body of 40 mm-diameter and 35 mm height, a bowl with a diameter of 60 mm and a linear feeder with a width of 8 mm, with the vibration bowl feeder and the linear vibration feeder used in a clever combination. Oscillating the bowl with an electromagnet causes the parts to flow spirally along the bowl outer course and into the assembly line via the linear feeder connected to the bowl.

This micro parts feeder enables micro parts to be arranged neatly on the assembly line at a fixed speed, which cannot be performed by an ordinary automatic parts feeder or by manual operations, so enables considerable efficiency improvement and labor conservation in production lines.



Micro parts feeder

*** Robotics Systems Engineering Corporation**

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Fax : +81-3-3806-6375

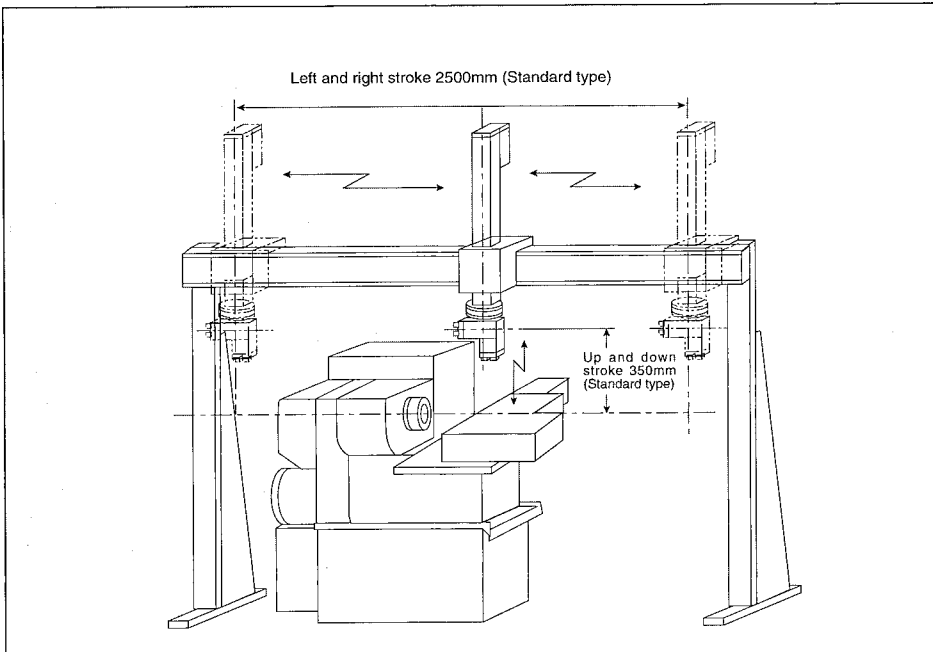
98-05-005-07

Orthogonal Biaxial Numerically-Controlled Gantry Loader

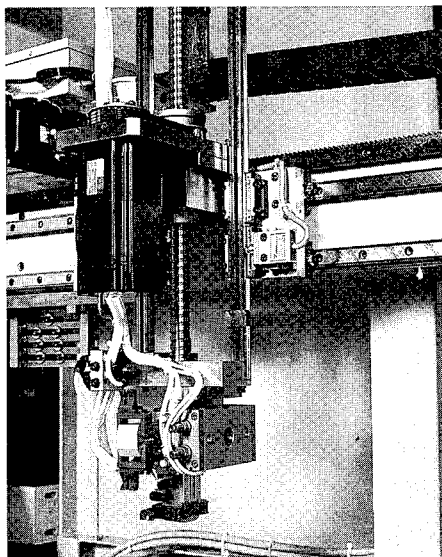
Makoto Kogyo Co., Ltd. has started marketing an orthogonal biaxial numerically-controlled (NC) gantry loader MLN-109 with multipoint stopping positions that can be set flexibly and which can be incorporated into machining systems with ease. It is sold at a domestic price of ¥3,500,000, about 30% lower than that of the company's existing hydraulic type gantry loader.

This new gantry loader integrates an orthogonal biaxial NC control system and a sequence control system, and moves the workpiece clamping hand horizontally and vertically, as well as carries the workpieces in and out of a machining system. A pair of AC servomotors is employed, so the stopping points can be set flexibly. Work programs of flexible motions can be prepared, and the entire assembly is designed as a simple structure.

A unique system is incorporated that enables motions to be confirmed, so this gantry loader can be incorporated in a monofunctional machining system or other in-line machining systems with ease. Programming is simplified by a built-in



Installation example



Orthogonal biaxial numerically-controlled (NC) gantry loader MLN-109

microcomputerized NC control system and the working point can be set flexibly. The system can be mounted early, is problem-free, and optional specifications include a workpiece feed system, a workpiece acceptance system and a clamping jig.

A maximum diameter of 100 mm, 200 mm long and weighing up to 1.5 kg can be conveyed over a maximum lateral distance of 2,500 mm and vertical distance of 300 mm, and the lateral and vertical motions are both performed at a speed of 50 m/min.

*** Makoto Kogyo Co., Ltd.**

Public Relations Dept.
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Construction & Transportation

98-05-006-01

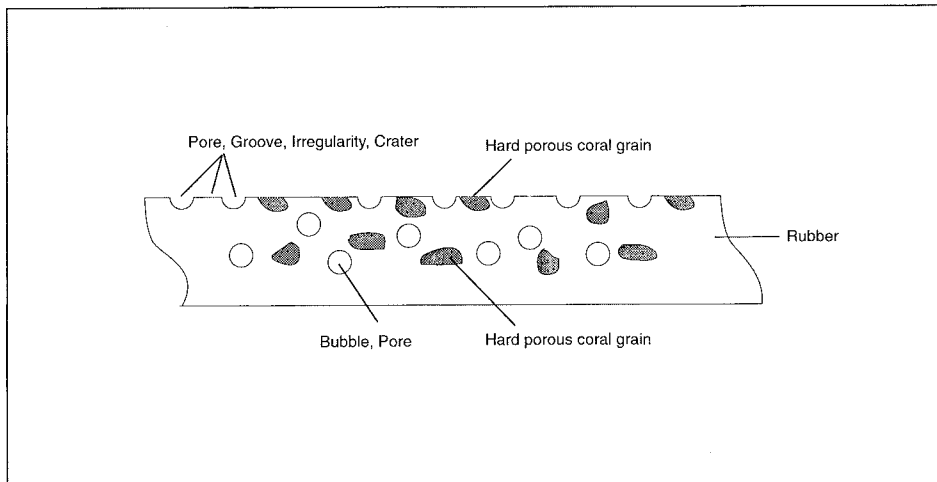
Tire Regeneration with Coral Grains

Nitteku Co., Ltd., has established a technology to regenerate studless tires by using coral grains. The use of hard porous coral grains prevents slipping on the roads,

and the company plans to put the tire on the market as early as this year end.

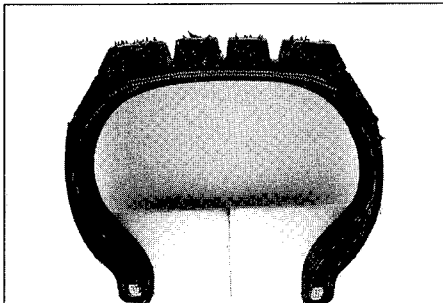
The rubber of the regenerated tire includes about 10% of coral grains crushed to a particle size of 0.1-0.6 mm. Coral consists of coral ceramic particles with an uneven surface area that is about 20 times

JETRO, May 1998

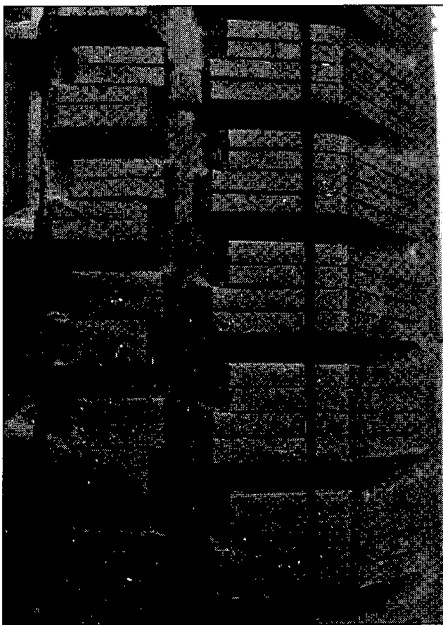


Cross section

larger than that of sand, and due to its extreme porosity, enables the regeneration of all-season studless tires which excel in elasticity and resist deformation even with temperature differences due to the innumerable air bubbles and air pores inside the tread part.



Studless tires using coral grains



Amplification

The tire features excellent water absorbency, water discharge and adsorbance, and the rubber porosity and the microspikes of the coral ceramic grains provide stubborn grip and braking force even on snow, packed snow and frozen roads throughout the seasons, therefore assuring great driving safety, in addition to being available at a moderate price. Further, since the coral consists mainly of natural animal calcium carbonate, the components are washed away with rain and purify river and lake waters.

Leading tire manufacturers are marketing foamed rubber tires as well as tires containing walnut shell grains for use in winter, but the newly developed regenerated tire displays the effects of both these types of tires. The cost of the regenerated tire is reduced by using imported coral in combination with used tires, so the new regenerated tire is expected to become available at a domestic price of ¥6,000-12,000.

* Nitteku Co., Ltd.

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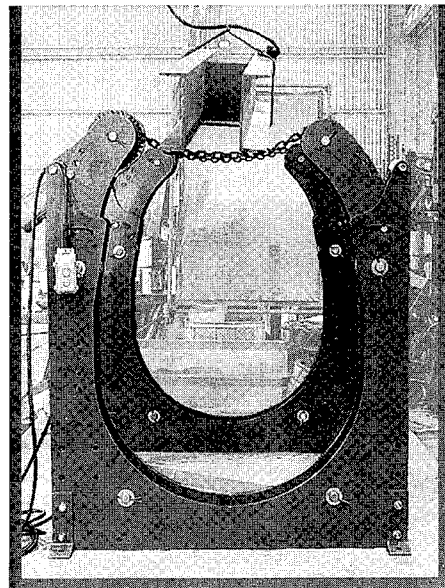
98-05-006-02

Ring Chain Type Rotary Machine for Efficient Steel Skeleton Welding

Shochiku Iron Works Co., Ltd. has developed and started marketing a Model NS2 Rotary Machine that is designed to rationalize the welding of steel skeleton for construction.

This ring chain type rotary machine eliminates the need for engaging or disengaging the workpieces when engaging in rotary motions, so that the work efficiency is improved by 50% compared with conventional types of rotary machines. It is marketed at a domestic price of ¥700,000.

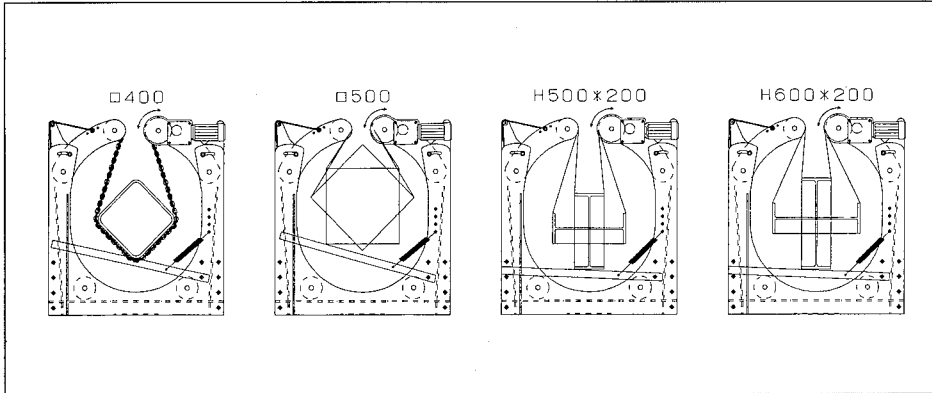
The upper part of the Model NS2 Rotary Machine consists of an opening/closing arm that is closed by the weight of the workpiece to be welded, and the ring chain assembly simultaneously wraps the workpiece like a pouch. The work of rolling the workpiece to its prescribed position is accomplished with a drive mechanism capable of revolving through 360 degrees and which is worked in linkage with the ring chain assembly. To prevent the workpiece from being oscillated by the ring chain assembly, the base part of the



Model NS2 Rotary Machine

rotary machine is equipped with an oscillation inhibition spring assembly. Patents are currently pending for the opening/closing arm assembly and the oscillation inhibition spring assembly.

The conventional type of rotary machine requires the workpiece to be engaged or disengaged when it revolves, but the new machine eliminates this need and therefore considerably decreases the usage frequency for a hoist crane, so that the work efficiency is improved by about 50%. Workpiece engaging or disengaging is accomplished simply by lowering the workpiece downward, while the ring chain



Operating method

assembly snugly and securely wraps around the workpiece like a pouch, thereby eliminating any slippages and increasing the speed of flat-position welding. An oscillation inhibition system is also incorporated, by which the machine durability is improved and maintenance simplified substantially.

The new rotary machine maximum loading capacity is 2 tons, so is ideal for welding beams and box-columns, H-steel of 200 × 100-600 mm × 300 mm can be worked, and is usable for welding box-columns of 200-500 mm².

* **Shochiku Iron Works Co., Ltd.**

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98-05-006-03

Voice Recognition Control System for Housing Facilities

Misawa Homes Co., Ltd. and Misawa Homes Institute of Research and Development Co., Ltd. have jointly developed a voice recognition control system for housing facilities. When the resident talks into a microphone, this actuates the facilities such as the illumination system, air conditioning system or TV set inside the residence. Whereas the remote control of home electrical appliances is becoming increasingly intricate, the new system made the operation of such appliances simple even to the elderly and the handicapped. The selling price has not been announced as yet, but it is expected to be less than ¥200,000.

The new voice recognition control system unifies the remote control signals and it differentiates from the daily conversational language. Moreover, this system does

not choose the voices of specific registered user. At present, about 300 words can be recognized, but research will be advanced further to expand the range of recognition to 500 words including dialects.

The main functions of the system are turning ON and OFF of electrical appliances and facilities such as the illumination, air-conditioning system, temperature control, TV set Video system and so on, as well as, its volume adjustment, channel selection, playback & recording and more. For example, when the user speaks to the microphone, "TV channel 8" the TV set is powered and set itself to channel 8. In the event of some ambiguous voice input, the system asks back, "Do you desire channel 8?" The same applies to illumination, the air conditioning system and the video system.

Even if a system made by a different manufacturer is employed in the house, the manufacturer can be registered through voice input, which enables the system to be employed even with newly procured electronic equipment made by different manufacturers. The voice recognition range is within a radius of 1 m, and the system is operable with the level of voice which is used in daily conversation.

* **Misawa Homes Co., Ltd.**

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98-05-006-04

High-Performance Engine Control Unit

Y.G.K. Inc. has developed the CYM 001 unit for effectively controlling automobile engines in response to changes in the external temperature and engine tem-

perature, and is already supplying the system to an European sports car manufacturer. Compared with counterpart systems available on the market, it is available at a lower price, and the company plans to develop a much more compact system for ordinary automobiles.

The CYM 001 system is characterized by fuel injection and ignition timing performed in perfect combination. The system can be used for engines of up to 8 cylinders and engine speeds of over 12,000 rpm, and provides closed loop lambda control of wide range, closed loop ignition timing control, and use of re-programmable ROM. Breakdown or failures can be identified by the Sophisticated Diagnosis Strategy System (a complete diagnosis program). The data storage memory is up to 256 kbytes, and can be interfaced with a personal computer. The system is 165 mm × 145 mm × 40 mm (connectors not included), and weighs 1.2 kg.



CYM 001

The following characteristics of the engine control are achieved: Air/fuel ratio control, ignition timing control, idle speed control, air-conditioner/compressor control, O₂ heater control, valve timing control, fuel pump control, cooling liquid electric fan control, data communications, data gathering and storage, A/T control, self-diagnosis system, evaporate solenoid control, air pump control, fail-safe design, exhaust pressure control valve control, SCV control, and OBD 2 specifications.

* **Y.G.K. Inc.**

Club Yellow Magic Dept.
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98-05-006-05

Car Navigation Software Displaying Direction of Advance with Spotlight

Sokisha Co., Ltd. has established a car navigation software that displays the direction of automobile advance. It will be fabricated into a printed circuit wafer and incorporated into a car navigation system. Drivers will be able to observe only the information necessary for driving, so the software may prevent accidents.

Conventional types of car navigation display systems indicate the current point and the destination point on the same display, but the amount of information is excessive because not only the map infor-

mation relating to the surrounding areas of both these points, but also map information relating to other areas are displayed on the same level. To easily and promptly find or set a rational route from the current point to the destination point or a passage point on the way, the driver is required to get used to the map display including the excessive amount of information, or to be experienced in map reading.

The ordinary map is constantly displayed over the entire rectangular screen and the driver must view the entire display while driving the vehicle, which is an accident hazard. Also, since unnecessary areas are displayed as excessive background information, it is practically impossible for

the driver to perceive information at a glance that is vital to view and assess the destination road and landmarks with respect to the current point and the destination point and to promptly and precisely grasp the necessary information relating to the current point and along the way to the destination point.

With the new system, the display of the current point is limited to a circular region of predetermined radius with the current point at the center and a fan-shaped region spreading out from the current point toward the destination point. The map information displays only the regions through which the driver will possibly pass in transit from the current point toward the destination point. Therefore, unnecessary map information is eliminated, and the screen only displays the map information relating to the current point and its background, and information relating to the area corresponding to the regions through which the driver will possibly pass later in transit to the destination point.

As a result, since excessive map information are not displayed on the screen, the map information can be read out easily and accurately in connection with the current point and the destination point, which achieves safer driving and less accident hazard.

It is also possible to display written information relating to traffic congestion and places under construction, or to display detailed maps relating to the destination point which are marked off on a translucent display. Such marked off map information displays various regional points with a sense of directivity, and the correlation of these regional points with overall regions is also indicated to offer instantaneous recognition support to drivers.

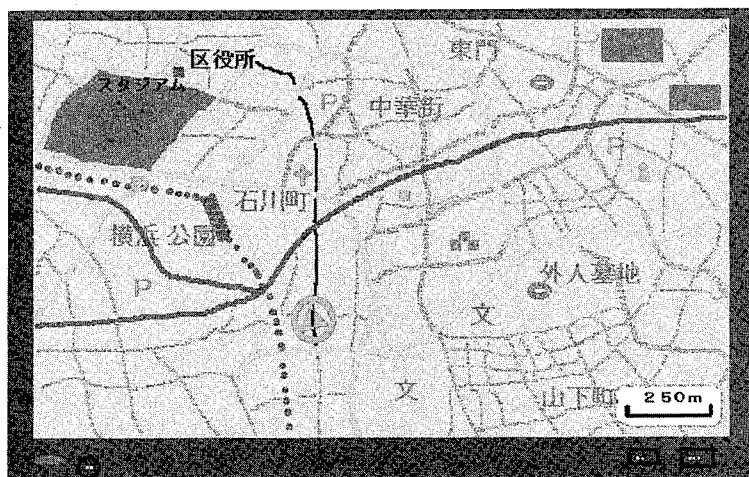
*** Sokisha Co., Ltd.**

Develop Relations Dept.

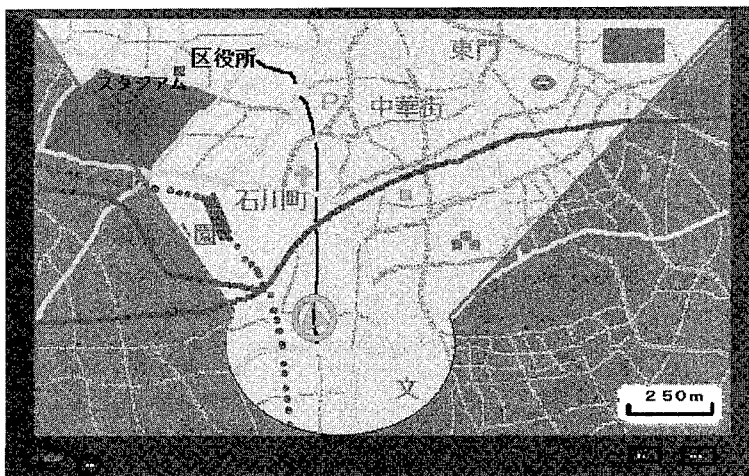
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Conventional display example

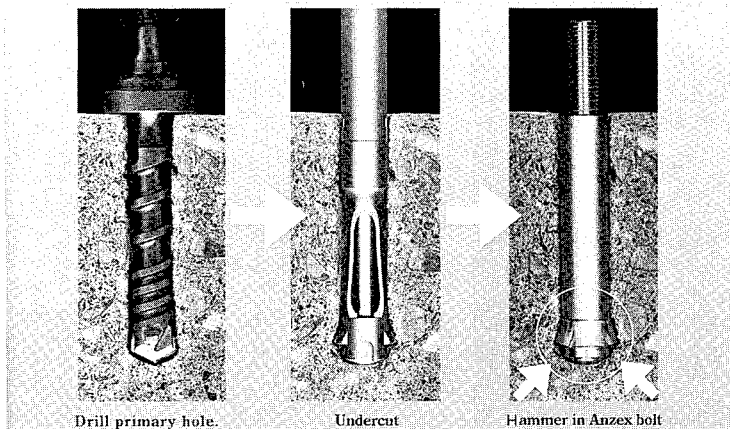


Spot light view (Tentative name)

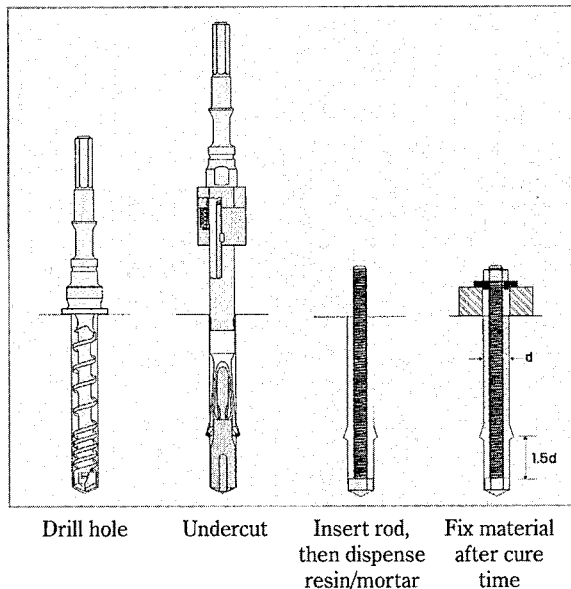
98-005-006-06

Undercut Anchor System

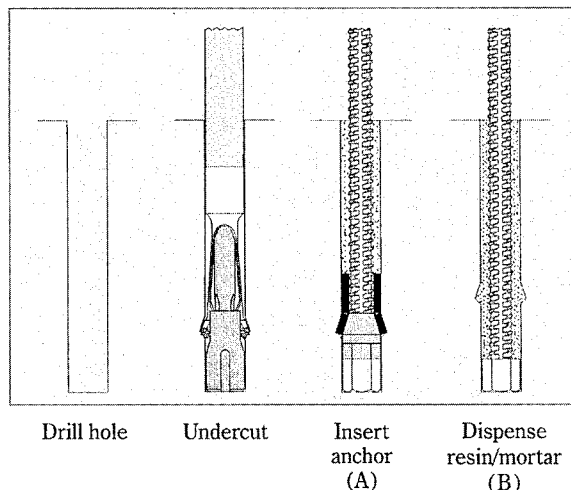
Miyanaga Co., Ltd. has started marketing an undercut anchor system, called the Anzex System, for the fixation of bolts into concrete structures. This is a special-purpose tooling system that widens the bottom of the pre-holes for driving anchor



Anzex system



Anchor for resin/mortar anchor



Heavy-duty anchor

bolts inside and which prevents the fixed bolts from being disengaged.

The system introduces special-purpose tools such as a pre-hole bit, an undercutter, a driving rod and an Anzex bolt, by which bolt fixation is now accomplished more easily, reliably and with stability. An undercutter of the smallest size is sold at a domestic price of ¥19,600.

In actual operations, a hole of the required depth is prepared with the pre-hole bit, the hole base part is next enlarged with the undercutter, after which special-purpose bolts (high-strength bolt or ordinary bolt) are driven in with the driving rod, then clamped firmly into position. By action of a stopper, the pre-hole can be opened to a uniform depth. Undercutting is accomplished rapidly, and the state of the completed operation confirmed visually. The cutter blade is changeable, and a small force suffices for driving in the bolts. Compared with the method of driving the anchor bolt straight inside the concrete, the expanded tip part is coupled with the concrete mechanically, so that the retention performance is improved considerably.

The system has already acquired the approval of the German Construction Technology Association (DIBT). It is available in the resin/mortar anchor system and the heavy-duty anchor system.

Resin/Mortar Anchor System Characteristics

- * Increased pull-out strength since the undercut is produced at a distance of approximately 1.5 diameters from the pre-hole bottom.
- * Reduced distances from slab edges.
- * No stress exerted in concrete structures.

* Resin/mortar protects bolts against corrosion.

Heavy-Duty Anchor System Characteristics

- * Diamond-tipped undercutter.
- * Suitable for fixing heavy loads into concrete structures.
- * Threaded rods enable operation with ease.

* **Miyana Co., Ltd.**

2393, Fukui, Miki, Hyogo, Pref. 673-0433

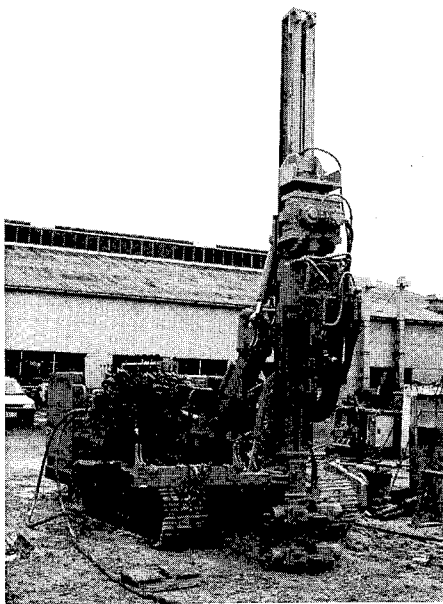
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98-05-006-07

Fully Hydraulic Low-Noise, High-Speed Excavator with High-Performance Power Drill

YBM Co., Ltd. has commercialized and started marketing a fully hydraulic type low-noise, high-speed excavator power drill RVD-625. The power drill percussion excavation mechanism has been replaced by the vibration excavation mechanism, by which the noise level has been lowered by about 15%. The excavator is sold from ¥20 million on the Japanese market.

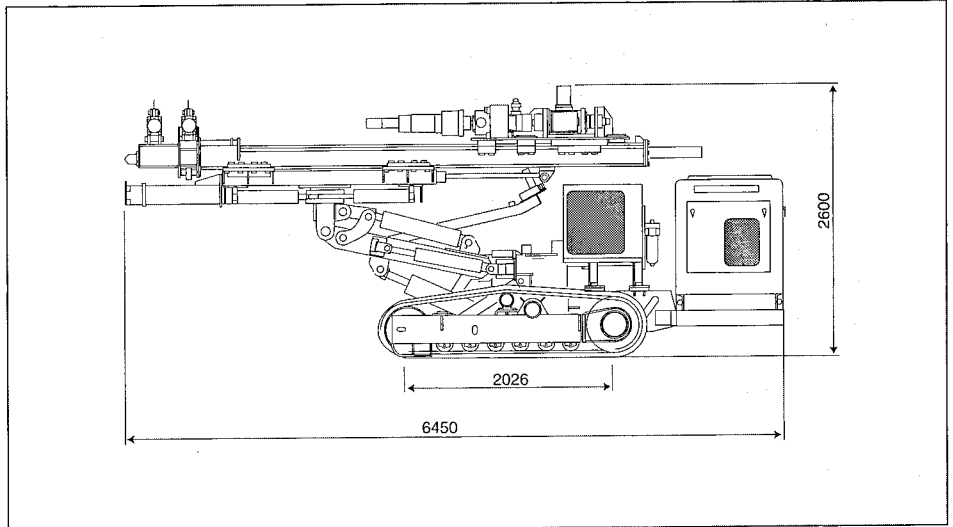


RVD-625

This high-speed excavator can work at high speed on all kinds of terrain from flimsy to rocky. Normally, a rotary percussion (RP) drill utilizes a combination of the rotary force and the percussion force, and the excavation speed is about 10 times that of the simple rotary type excavator. However, the excavator applies the combination of the rotary force and the reciprocal percussion force and therefore generates a tremendous percussion noise, making it unsuitable for use in urban regions.

The new power drill is an application of the vibration technology that is used in the vibrohammer, and by applying the vibration technology in combination with the rotary force, the excavation speed becomes comparable to that of the rotary percussion excavator. In addition, the noise has been lowered to about the same level as that of

JETRO, May 1998



Excavator dimensions

the simple rotary type excavator. At a point 7 m away from the excavation spot, the noise is 75 dB, as compared with the noise level of 90 dB of the rotary percussion type excavator.

YBM Co., Ltd. is marketing the power drill in the skid (fixation) type, the self-running type and the backhoe-mounted type. The excavator specifications are:

Number of vibrations 2,000 cycles/min, vibration force 4.5 t., rotary torque 800 kg.m.

* **YBM Co., Ltd.**

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98-05-006-08

Passenger Plane Mirror for Visual Surveillance of Passenger Accommodation

Komy Kogei Co., Ltd. has developed a passenger plane mirror FF Mirror Air for the visual surveillance of passenger accommodation. The plane mirror features the functions of a convex mirror that minimizes the dead angle inside the passenger accommodation. Therefore, crew members who have to keep 70-80% of the passenger accommodation in their vision when passengers affix their seat belts can utilize these mirrors to confirm the state of seat belt affixation of passengers far in the back, or to confirm the situation over a broader range.

This new plane mirror is basically made of polycarbonate, features a strength that is 300 times that of mirrors made of glass,

has a stubborn resistance to damage, and can be fabricated in a thin and ultralight weight configuration.

A mirror usually has the same light incidence angle and reflection angle, but FF Mirror Air introduces a special type of technology for a polycarbonate polymer material as the basic material and introducing the Fresnel principle applied to the camera lens, so that the mirror, while retaining a plane shape, functions like a convex mirror and provides a wide vision not available with plane mirrors. The polycarbonate material has a strength that is about 300 times that of glass, and the mirror surface has a hard coating like a spectacle lens, so is not cracked, resists damage and can be produced thin and ultralight weight.

FF Mirror Air, to enable mounting onto aircraft, is produced in a flame resistance multilayer structure consisting of a layer of polycarbonate, a layer of aluminum alloy and a layer of aluminum extruded shape, which are laminated together with a bonding agent. A form elastic bonding agent is used to permit the mirror to fit in any desirable part of the passenger plane with ease. This mirror is the first of its kind in the world. The mirror has passed all kinds of combustion tests, and its specifications were approved as fully complying to aircraft needs by the Ministry of Transport in April, 1997.

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Energy & Resources

98-05-007-01

Technology to Stabilize Methane Gas by Enclosing in Ice

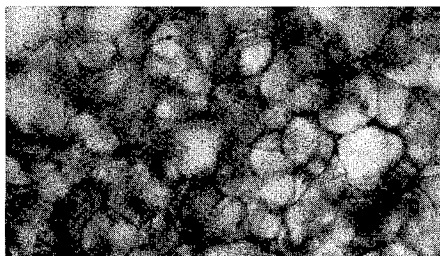
Hokkaido National Industrial Research Institute, Ministry of International Trade and Industry, has established a technology to stabilize methane gas, a component of natural gas, by enclosing in ice. This enables natural gas to be transported at low cost.

Up till now, natural gas was generally transported by maintaining in a cryogenic state for transportation in the form of liquefied natural gas (LNG), but since liquefaction demands an enormous volume of energy, much cost was expended to maintain the gas in a cryogenic state.

While dependent on the temperature, methane hydrate is formed in about 20 min when water and highly pressurized methane gas are mixed together and agitated. The hydrate has a structure in which methane gas molecules are enclosed inside the basket made of water molecules formed by this process, and it can contain about 200 times its volume of methane gas. Methane hydrate may be regarded as ice containing methane gas in high concentration.

The Resources and Energy Division conducted research in which water and methane gas were mixed together at a ratio of 1:70 (at 1 Pa), treated under the conditions of 0.4 °C and 70 atmospheres pressure, and separated the surplus water from the water and hydrate slurry that was generated. Next, the mixture was frozen at -15 °C and the state observed with a polarization microscope, which showed that fine hydrate crystal grain clusters were generated in dispersion.

The phenomenon of the decomposition rate of methane hydrate frozen together with water had been observed to be substantially delayed, so that the decomposition of methane hydrate was considered to be suppressed by the presence of ice between the methane hydrate crystal grains. Therefore the ice is behaved as a high pressure vessel. This situation suggests the future possibility of natural gas transportation using a natural gas hydrate tanker in place of the existing liquefied natural gas tanker.



Photomicrograph of methane hydrate

The team plans further research to increase the gas storage density by decreasing the ice ratio as well as to slow the decomposition of methane hydrate in the form of fine crystals, to establish a natural gas transportation and storage technology utilizing methane hydrate.

*** Hokkaido National Industrial Research Institute**

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98-05-007-02

Continuous Manufacture of Germanium in Spherical Form

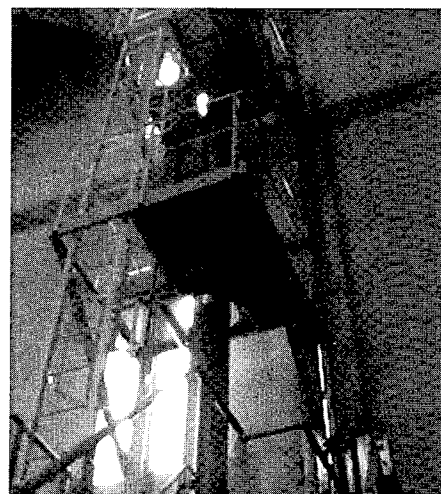
Hokkaido National Industrial Research Institute, Ministry of International Trade and Industry has succeeded in the continuous manufacture of germanium, a semiconductor material, in perfect spheres. Molten germanium is dropped inside a tube under controlled atmosphere such as vacuum and appropriate low pressure gas, then cooled during dropping to form germanium of perfect spheres. Germanium and other semiconductor materials are used in solar cells or optical devices, and these semiconductors in perfect spheres improve the sunlight or light acceptance efficiency.

When liquid substances such as molten germanium are dropped, the conditions of microgravity are present in which almost no gravity exists. The liquids maintained in a spherical state under microgravity conditions. A 13-m drop tube constructed in Hokkaido National Industrial Research Institute was used to produce germanium in spherical shape continuously. The drop tube is employed only for cooling and so-

lification processing of molten substances, but enables solid substances to be produced continuously by continuous dropping of molten substances from the top of the drop tube.

Under microgravity conditions, material weight becomes virtually zero, and since there is no thermal convention, it is possible to disperse substances of different densities uniformly, and the effect of surface tension becomes enlarged, so the surface of liquid becomes spherical. A semiconductor molten liquid is placed in such an environment, it assumes a spherical shape, and the semiconductor material converted from molten state to solid state becomes a single crystal. By applying this process to germanium, a typical optical semiconductor material, it was possible to produce single crystal germanium of perfect sphericalness.

Single crystal spherical semiconductor material has not been manufactured previously, and is anticipated to be useful in various applications. For example, it is usable for manufacturing solar cells featuring large surface areas by aligning many semiconductor spheres with excellent light acceptance efficiency, three-dimensional devices (present devices produced in thin-film form and two-dimensional), and photocatalysis for prevention of environmental pollution.



13m drop tubes

*** Hokkaido National Industrial Research Institute**

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Environment

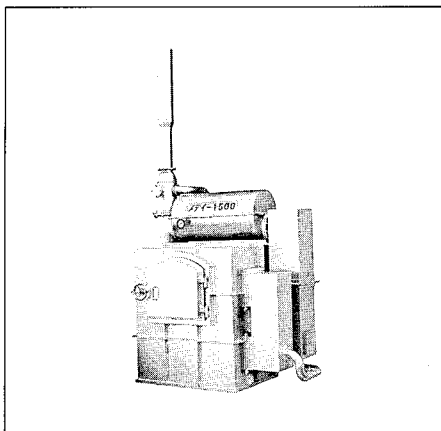
98-05-008-01

Special-Purpose Distillation Combustion Type Incinerator for Medical Treatment Waste

World Clean Service Co., Ltd. has developed a compact special-purpose medical treatment waste incineration system Medi 1500 based on the distillation combustion system which suppresses the generation of dioxin by high-temperature combustion. The incinerator features a unique combustion chamber structure and consists of three chambers, a distillation chamber, a primary combustion chamber and a secondary combustion chamber. By using a newly developed ceramic as the wall material of these combustion chambers, the compact combustion system achieves combustion at a temperature as high as 1,300 °C and therefore suppresses the generation of dioxin.

The incinerator is designed to completely combust wastes in general as well as vinyl chloride products such as waste plastic dialyzers without generating smoke or offensive odors. The system has a waste combustion capacity of 100 kg/day and weighs 2.8 t. The waste is first heated in oxygen-free state in the distillation chamber, and the generated gas combusted completely with burners in the combustion chambers. The treated waste is passed through the combustion process of over 800 °C and infectious substances are treated exhaustively by complete distillation, so there is no hazard of these substances to contaminate the soil or water at the disposal site or surrounding areas.

In general, a compact incinerator cannot be used for high-temperature combustion, but by combusting the gas in stages with the two combustion chambers, combustion is accomplished at a high temperature of 1,300 °C. Also, high-temperature combustion accelerates wall material deterioration, but a newly developed special type of castor is used that permits the wall material to withstand intense heat of over 1,500 °C, and the material also undergoes alumite coating treatment, by which the durability is improved considerably.



Medi 1500

Small quantities of dioxin exist even in ordinary waste gases, so the combustion gas passed through water which is contained a special type of enzyme to decompose hydrogen chloride that is a dioxin component, so that the exhaust gas becomes smoke-free and odorless. The combustion ash and metals after combustion is treated by consignment to a separate special-purpose enterprise.

The incineration system is sold at a domestic price of ¥15 million, or available at a cost of ¥300,000/month under a five-year lease contract. The fuel is kerosene. Treating medical treatment wastes with this incineration system will prove less costly compared with the method of consigning the work to a specialized treatment enterprise.

* **World Clean Service Co., Ltd.**

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98-05-008-02

Technique to Recover Phosphoric Acid from Sewage Sludge Incineration Ash

Prof. I. Komasaawa and his research team of the Department of Chemical Science and Engineering, Graduate School of Engineering Science, Osaka University, have jointly established a technique to recover phosphoric acid from sewage sludge incineration ash. The technique was developed

by applying a combination of the solvent extraction process, the leaching process and the precipitation process. The technique not only enables sewage sludge incineration ash to be reutilized effectively, but is expected to provide other advantages such as the prevention of seawater eutrophication through phosphoric acid effusion and the prevention of environmental pollution.

Sewage sludge incineration ash contains about 18% of phosphorus, which is equivalent to the content of low-quality phosphor ore. Phosphorus is used not only as a fertilizer but as a raw material for producing industrial chemicals and medical drugs, and there is a global trend of phosphor ore shortages in the years ahead. Therefore, for Japan that is relying on imports for the entire volume of phosphorus consumed in the country, the recovery of phosphorus from these wastes constitutes a vital matter.

The research team attempted to establish a process to recover phosphoric acid from sewage sludge incineration ash by applying the solvent extraction process, the leaching process and the precipitation process in combination. The sewage sludge incineration ash is leached by hydrochloric acid. The leachant fluid contained phosphoric acid and metal inclusions, and iron in the leachant was removed by bis (2-ethylhexyl) phosphoric acid (D2EHPA).

After extraction, the raffinate solution was mixed with ammonium solution to form precipitate consisting primarily of aluminum phosphate, with most metallic ions left in the filtrate solution. The precipitate was dissolved in hydrochloric acid from which phosphoric acid was extracted with tri-n-butyl phosphate (TBP). The loaded solution was scrubbed with phosphoric acid, which came from the stripping stage, to remove coextracted hydrochloric acid. The present extraction was successfully carried out, since the extraction of phosphoric acid by TBP was much enhanced by the presence of hydrochloric acid. These processes were combined together, which led to the establishment of the process to recover phosphoric acid from sewage sludge incineration ash.

When sewage sludge incineration ash was leached at a solid/liquid ratio of 1:10 (g/ml), it was possible to leach the phosphorus content by about 80% using hydro-

chloric acid of 0.8 mol/l. Ammonia water of the required concentration was added to the raffinate obtained through the D2EHPA extraction process to form a precipitate. Constituent gelled elements other than aluminum and chromium were little observed in the precipitate.

The McCabe-Thiele calculation method was employed and the material balances of acids in the process were presented. The TBP phase in which phosphoric acid and hydrochloric acid were retained in the extraction stage was scrubbed with a part of the phosphoric acid obtained through the stripping stage and hydrochloric acid and metal inclusions were removed completely. A TBP phase containing only high-purity phosphoric acid was obtained, and stripping with water provided phosphoric acid of high purity.

*** Osaka University**

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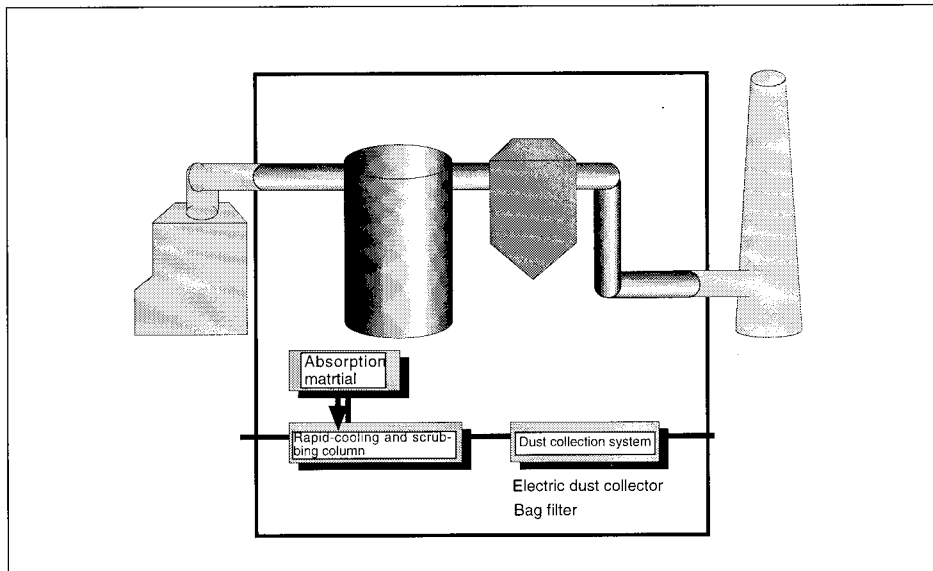
98-05-008-03

System to Prevent Emission of Dioxin from Incinerators

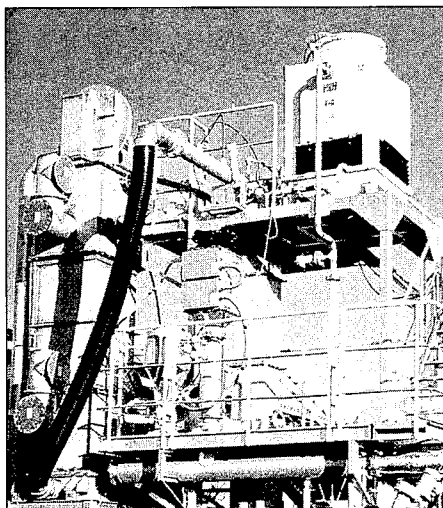
Kurita Water Industries, Ltd. and Chiyoda Engineering Co., Ltd. have jointly developed and started accepting orders for a system that prevents the emission of toxic dioxin from incinerators. Dioxin generation is prevented by utilizing the huge volume of thermal energy in combustion waste gas, as the gas is passed through water, then cooled and dehumidified. The system is sold at a domestic price that is about 20% less than that of existing systems of comparable capacities.

The dioxin exhaustion inhibition system was developed by combining Chiyoda Engineering exhaust gas treatment technology and Kurita Water Industries activated carbon technology. It is designed for application to comparatively small-scale incinerators with combustion capacities from 200 kg to 8 tons per hour.

The basic system consists of a rapid-cooling and scrubbing column, a dust collection system (electric dust collector or a bag filter) and an absorption material. The system is available in a series of three models depending on the type of the lat-



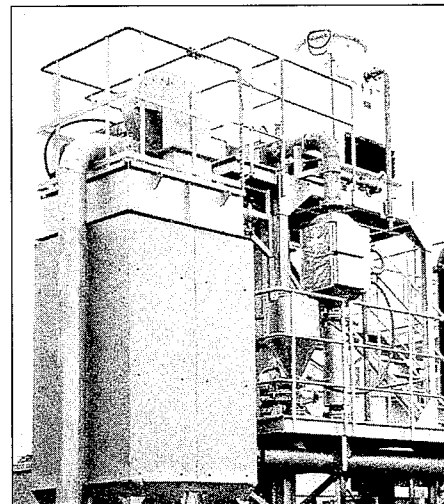
Waste gas treatment apparatus for dioxin



KE type (CDE system)

ter-stage dust collector. The general name of the basic system based on cooling and dehumidification is CD System, which is available in the CDN System, the CDE System and the CDB System depending on the ultimate exhaust gas treatment method.

With these systems, the high-temperature gas (500-700 °C) discharged directly from the incinerator is cooled to less than 100 °C with the rapid-cooling and scrubbing column and simultaneous dust removal, by which dioxin precursory substances are prevented from combining into dioxin, while the already generated dioxin is adsorbed and removed by the adsorbent mixed into the rapid-cooling and scrubbing column washing fluid. Further, the dust and adsorbent containing dioxin adhesions



KB type (CDB system)

which exist in the rapid-cooling and scrubbing column exhaust gas are collected with the latter-stage dust collector to prevent the emission of dioxin discharged in the form of solid particles.

The characteristics of these systems, for which patent rights are now pending, may be summarized as follows:

KE Type (CDE System)

Subsequent to cooling and dehumidification, the fine particulates existing in the exhaust gas are collected together with white smoke by the electric dust collector.

Dioxin is removed completely.

System is usable under harsh conditions, such as air capacity surging.

Maintenance is performed with ease due to the small number of drive parts and wearing parts.

Exhaust gas contains little white smoke.
KN Type (CDN System)

Subsequent to cooling and dehumidification, the exhaust gas is discharged after simplified mist treatment.

Simplified type usable for treating exhaust gases of low dioxin and dust contents.

System is simple and maintenance accomplished with ease.

Available at a low cost.

System can be later remodelled into a CDE or CDB system if necessary.

KB Type (CDB System)

Subsequent to cooling and dehumidification, the exhaust gas is heated and the dust collected with a bag filter.

Dioxin is removed completely.

Bag filter is operable safely at a low temperature of 80-100 °C.

Low-temperature synthetic fiber bag is usable.

Bag filter working air capacity rate become 50-70% of conventional types of dioxin inhibition systems.

Exhaust gas contains little white smoke.

* **Chiyoda Engineering Co., Ltd.**

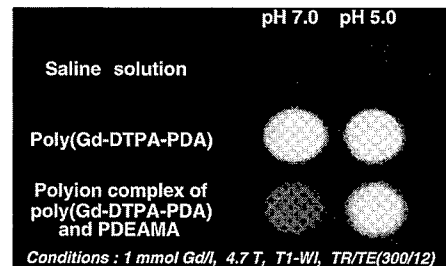
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MRI phantom study of poly (Gd-DTPA-PDA) (20%) and polyion complex of poly (GD-DTPA-PDA) (20%) and PDEAMA

molecules. Control the mutual reactions between Gd molecules and water by the method of microenvironment response, it will allow switching image signals ON and OFF by reflecting the microenvironment.

The polymerized MRI contrast agent, poly (DTPA-PDA), was synthesized by polymerizing diethylenetriamine pentaacetic acid cyclic anhydride (DTPAA) and propyldiamine (PDA). Poly (Gd-DTPA-PDA) (20%) was prepared by inducing Gd in 20% of the DTPA portion of the obtained poly (DTPA-PDA). The pH-sensitive polymer, poly (diethylaminoethyl methacrylate) (PDEAMA) was obtained through radical polymerization.

When the pH5 and pH7 solutions consisting of poly (Gd-DTPA-PDA) (20%) and a compound of poly (Gd-DTPA-PDA) (20%) and PDEAMA were evaluated by MR imaging analysis, strong anodic images were recognized with both pH5 and pH7 solutions when poly (Gd-DTPA-PDA) (20%) was used independently. Meanwhile, when the compound solution was used, a strong anodic image was displayed at pH5, but a substantial decrease in brightness was displayed at pH7. Therefore, the target of switching the signal ON with an acidic solution and the signal OFF with a neutral pH value, or of signal strength switching by relying on the pH value was recognized.

The contrast agent was developed by adding improvements to the Gd imaging agent that is used frequently in MR imaging operations. This type of contrast agent displays a whitish image when the T₁ of the water molecule is shortened by Gd. This new contrast agent has a construction in which Gd is packed inside a polymer pouch, and Gd is discharged only when the pouch is loosened when the acidity is high.

Biotechnology & Medical Science

98-05-009-01

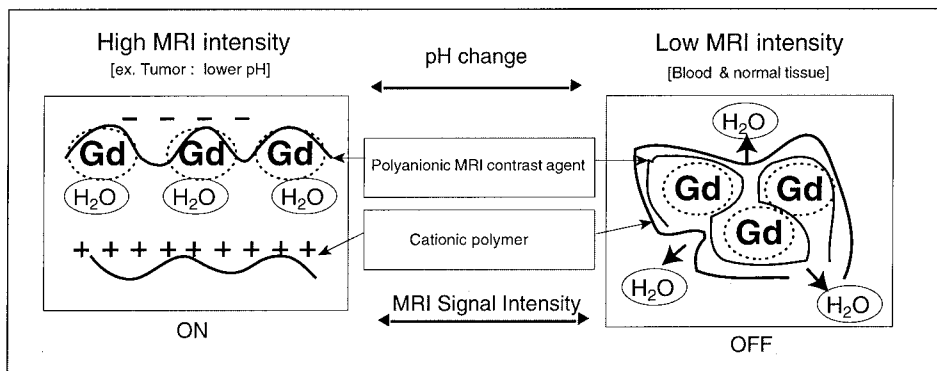
pH-Sensitive Contrast Agent for Functional Magnetic Resonance Imaging

A joint research team organized by Professor T. Akaike of the Faculty of Bio-science and Biotechnology, Department of Biomolecular Engineering Tokyo Institute of Technology, and members of Nippon Schering K. K. has developed a pH-sensitive contrast agent for magnetic resonance (MR) imaging systems that selectively shows the images of only cancer cells. It is capable of displaying even small cancer growths, so the system is anticipated to prove highly beneficial for the early discovery and treatment of cancer. The system's effectiveness has been confirmed through animal experiments, so the research team plans further research to corroborate the system's effectiveness and

safety with the aim of commercializing a system applicable to human cancer and other treatments.

This contrast agent, based on a new concept, is a microenvironment-responsive type MR imaging contrast agent capable of manifesting signals by responding to the states of afflicted parts such as the cancerous portions of the body. For example, the pH value of a cancer tissue is reported as being lower than that of a normal tissue, so the development of a pH-sensitive MR imaging contrast agent with the image depicting signals turned ON and OFF in response to changes in the pH value will enable display of only the afflicted parts of the body selectively.

The principle of imaging of a gadolinium (Gd)-based contrast agent is based on the property of Gd to shorten the longitudinal relaxation time (T₁) of water



pH-sensitive MRI contrast agent based on polyion complex

Cancer cells have a higher proliferation capability than ordinary cells, so consume a larger volume of energy. During anaerobic glycolysis, glutaminolysis and ATP hydrolysis hydrogen ions are formed which are actively transported outside the cell, with the result that they display a high interstitial space acidity (low pH value indicating hydrogen ion density). Therefore, the new contrast agent does not create any image in connection with healthy cells but readily displays cancerous cells.

The agent reacts only when the acidity is high because the mouth of the polymer pouch containing Gd is designed to open or close in conformance with the degree of acidity. In experiments using mouse injected with colon carcinoma cells by mouse, only the cancer cells were displayed in white.

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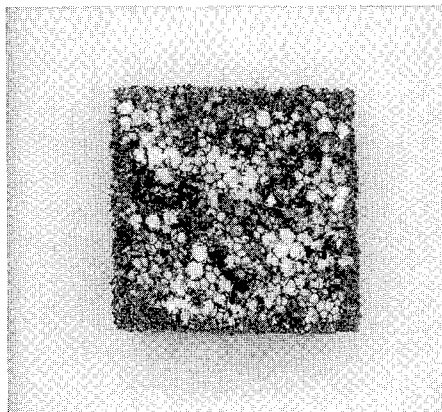
98-05-009-02

Technology to Utilize Flocculent Yeast for Continuous Operation of Bioreactors

Prof. H. Fukuda and his research team of the Graduate School of Science and Technology, Kobe University, have established a technology to utilize flocculent yeast for the continuous operation of bioreactors. Normally, when using yeast to produce medical raw materials, the yeast tends to lose its activity and thereby deteriorate the production capacity. With the new technology, yeast is cultured with a porous polyurethane carrier, and yeast cells which have lost their activities are exfoliated naturally. Only yeast of high activity remain as carriers to enable continuous production with bioreactors.

The research team incorporated the yeast with enzymes containing rat liver microzomes, and confirmed the new metabolic process exfoliation of the flocculent yeast cells which have lost activity. In experiments, *Saccharomyces cerevisiae* ATCC 60715 was used as flocculent yeast suitable for immobilization and culturing.

A co-manifestation plasmid (pAMR2) consisting of rat liver P450 monooxygenase gene and yeast reductase



Immobilization yeast

underwent character transformation into flocculent yeast by the acetic acid lithium process. The BSPs were 6-mm foamed polyurethane, and as the model reaction, a reaction to transform acetanilide into acetaminophene was performed inside a 3-liter circulating bed fermentor. Flocculent yeast was immobilized within BSPs in 51 hrs of culturing, after which bioconversion was performed five times with a cycle of 8 hrs inside the same bioreactor.

During the reaction cycles, the amount of biomass within BSPs was stabilized at about 15 mg/BSP, and there was hardly any deterioration in the metabolic activity in the respective cycles. When the metabolic activities of the immobilized yeast cells and the exfoliated freely suspended yeast cells after five cycles were compared, it was confirmed that the former offered values which were equivalent to or surpassed the activation values directly after immobilization, whereas the latter hardly displayed any activity. Also, the plasmid retention ratios were respectively 70% and 43%. As judged from these results, the activities of yeast cells retained inside BSPs are always more intense, and the exfoliation phenomenon occurs whenever the function is deteriorated.

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98-05-009-03

Amoxicillin-Resistant *Helicobacter Pylori* Discovered

Assoc. Prof. S. Sasatsu and his research team of Showa College of Pharmaceutical Science have discovered a strain of

Helicobacter pylori that is resistant to amoxicillin, a penicillin antibiotic substance. *H. pylori* is a cause of gastritis, stomach ulcer and is also associated with stomach cancer.

Recently, the highest rate of eradication of the bacteria was achieved by using a combination of proton pump inhibitor (PPI) that stops gastric acid secretions, clarithromycin (CAM) and amoxicillin (AMPC). The eradication therapy is reported in Western countries as well as in Japan to display an eradication rate of more than 90%. However, there are fears of side effects due to excessive dosages of multiple antibacterial drugs as well as the emergence of resistant bacteria.

CAM has an antibacterial effect against *H. pylori* that is next to AMPC, and the bactericidal effect is stronger than that of AMPC. However, whenever the emergence of resistant bacteria is high (about 13%), there is actually a larger number of examples of faulty eradication therapy in connection with administration of CAM to patients.

AMPC has the greatest antibacterial effect with respect to *H. pylori* and displays a bacterial suppression effect even with an extremely small dosage, but its primary disadvantage lies in its weak bactericidal effect. Up till now, there has been no report of the existence of AMPC resistant strains of *H. pylori*. The 2 strains resistance to AMPC were isolated in Japan. One strain has resistance to AMPC and the other has resistance to AMPC and cefaclor (CCL). The minimum inhibitory concentration (MIC) of AMPC to the strains is increased to 12.5 µg/ml, which is 1,000 times higher than that of the sensitive strains.

The mechanism of the AMPC resistance of the strains was the decrease of binding affinity of the penicillin binding proteins (PBPs) with AMPC and CCL. The PBPs are the enzymes regarding to the synthesis of the cell wall of bacteria. This is the same mechanism as those of methicillin resistant *Staphylococcus aureus* (MRSA) and penicillin resistant *Streptococcus pneumoniae* (PRSP).

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FLASH

Special Stereoscopic Copying System for the Visually Handicapped

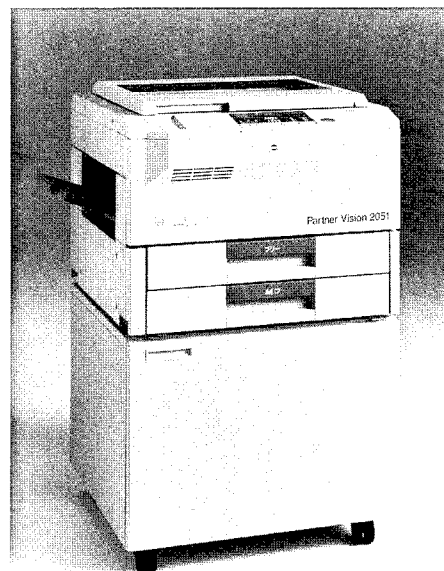
MINOLTA Co., Ltd. has started marketing a special copying system (Partner Vision 2051) for a stereoscopic copying system for use by the visually handicapped. The stereoscopic copying system was jointly developed by Minolta Co., Ltd. and another company in 1980. It allows Braille manuscripts, pictures, maps and graphs to be copied into stereoscopic form and therefore makes the conventional type of copier for the visually handicapped much more convenient than before. The new system consists of a capsule paper, a special-purpose developer and a special-purpose copier, and is sold by Matsmoto Kosan Co., Ltd.

The target copying object is first copied on a special-purpose capsule paper with the stereoscopic copier. The capsule paper is made of a thermally expanding microcapsule material that is instantaneously

expanded by about 100 times when exposed to heat. Next, the paper is passed through the special-purpose developer, when heat is absorbed in conformance with the depths of the colors transferred onto the microcapsules, and these microcapsules are expanded to provide a stereoscopic copy.

By applying this principle, it is now possible to produce Braille characters, pictures, maps and graphs in stereoscopic delineation to enable recognition much easier than before simply by running the fingertips over the paper surface.

Simply inserting the special-purpose capsule paper copied with the EP2051 Stereoscopic Copier into the Stereoscopic Copy Developer YMT-A3 enables this copier to be used in an ordinary copying machine. The contraction ratio is down to 50% and the magnification ratio up to



Partner Vision 2051

200%, and zooming in 0.1% graduations is possible flexibly. Ancillary equipment such as the trays are all given an antibacterial coating, so the copying system is constantly maintained in a sanitary condition.

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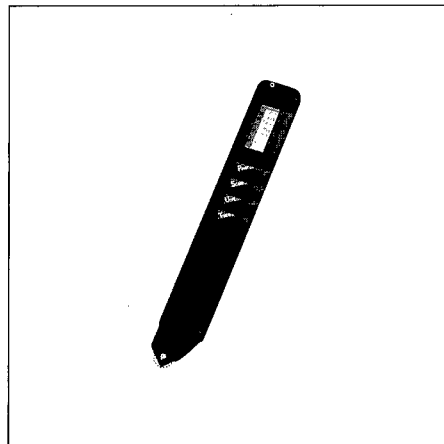
Moderately-Priced Version Pen Type Curvimeter

KOIZUMI Sokki Mfg. Co., Ltd. has started marketing a moderately-priced version pen type curvimeter. The company's present pen type curvimeters are priced at ¥12,800, but the new product is sold at ¥9,500. The company plans to switch its pen type curvimeters over to the moderately-priced versions.

The new product is called COMCURVE-9 Jr. The cost has been reduced substantially by changing the arrangement of the integrated circuits (ICs), by which the cost has been lowered by roughly 30%. The battery has also been changed to the UM4 type to improve the availability.

With a curvimeter, the rotary part of its pen tip is run along a map, by which the transit distance is computed automatically. The pen type design enables the curvimeter to be carried around conveniently in the pockets, and is quite convenient for use when going out on driving, hiking or walking trips.

The specifications may be summarized as follows: Custom liquid crystal display sharing a 6-digit plus-minus sign display. The detector element uses a photointerrupter. The LSI forming the calculating system usage a 6-digit representation with floating decimal point. The measuring range is 10 m (actual measure-



COMCURVE-9 Jr.

ment), with a minimal indication on the display of 1 mm. The weight is 50 g.

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